NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

THE IMPACTS OF A FULLY FUNDED POSTGRADUATE EDUCATION ON PROMOTION AND COMMAND SCREEN FOR FIXED-WING, CARRIER-BASED PILOTS AND NAVAL FLIGHT OFFICERS.

by

W. Brent Phillips

March, 2001

| Thesis Co-Advisors: | William R. Bowman |
| | Stephen L. Mehay |

Approved for public release; distribution is unlimited.

20010618 092

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE March 2001	3. REPORT TYPE AND DATES COVERED Master's Thesis	
4. TITLE AND SUBTITLE : The Impacts of a Fully-Funded Postgraduate Education on Promotion and Command Screen for Carrier-Based Pilots and Naval Flight Officers.		**5. FUNDING NUMBERS**	
6. AUTHOR(S) Phillips, William B.			
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School Monterey, CA 93943-5000		**8. PERFORMING ORGANIZATION REPORT NUMBER**	
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)		**10. SPONSORING/ MONITORING AGENCY REPORT NUMBER**	

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release; distribution is unlimited.	12b. DISTRIBUTION CODE

13. ABSTRACT *(maximum 200 words)*

This thesis evaluates the effect of fully-funded graduate education on the joint outcome of promote to Pay Grade 5 and screen for squadron command for fixed-wing, carrier-based aviator lieutenant commanders (Pay Grade 4) eligible for the Pay Grade 5 board. Binomial logit models are estimated to examine the impacts of earning a graduate degree, the timing of the degree, and the technical specificity of the degree. The thesis finds no evidence that career progression at this critical point is harmed by acquiring a fully-funded graduate degree. Rather, the thesis finds significant positive effects on promote/screen for those officers earning advanced degrees at selected junctures.

Logit model estimates show that aviators with fully-funded technical degrees earned one or more years after the Pay Grade 4 board are 26.9% more likely to promote/screen than aviators without graduate degrees. Additionally, officers who earned graduate degrees on their own time are 5.8% more likely to promote/screen than officers without graduate degrees.

14. SUBJECT TERMS Graduate Education Aviation Aviator Promotions		15. NUMBER OF PAGES 152
		16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT UL

THE IMPACTS OF A FULLY FUNDED POSTGRADUATE EDUCATION ON PROMOTION
AND COMMAND SCREEN FOR FIXED-WING, CARRIER-BASED PILOTS AND NAVAL
FLIGHT OFFICERS

William B. Phillips
Lieutenant, United States Navy
B.J., University of Missouri--Columbia, 1990

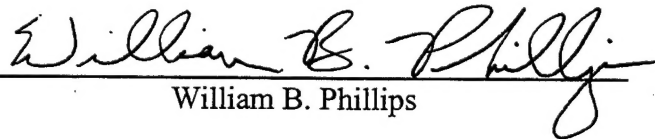Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN LEADERSHIP AND HUMAN RESOURCES
DEVELOPMENT

from the

NAVAL POSTGRADUATE SCHOOL
March, 2001

Author: _____
William B. Phillips

Approved by: _____
William R. Bowman, Thesis Co-Advisor

_____
Stephen L. Mehay, Thesis Co-Advisor

_____
Reuben T. Harris, Dean
Graduate School of Business and Public Policy

iii

ABSTRACT

This thesis evaluates the effect of fully-funded graduate education on the joint outcome of promote to Pay Grade 5 and screen for squadron command for fixed-wing, carrier-based aviator lieutenant commanders (Pay Grade 4) eligible for the Pay Grade 5 board. Binomial logit models are estimated to examine the impacts of earning a graduate degree, the timing of the degree, and the technical specificity of the degree. The thesis finds no evidence that career progression at this critical point is harmed by acquiring a fully-funded graduate degree. Rather, the thesis finds significant positive effects on promote/screen for those officers earning advanced degrees at selected junctures.

Logit model estimates show that aviators with fully-funded technical degrees earned one or more years after the Pay Grade 4 board are 24.3% more likely to promote/screen than aviators without graduate degrees. Additionally, officers who earned graduate degrees on their own time are 5.7% more likely to promote/screen than officers without graduate degrees.

TABLE OF CONTENTS

ACKNOWLEDGMENT

x

I. INTRODUCTION

"In a message to the fleet describing the results of a Commander Command Screen Board, the writer stated that the board selected officers based on war fighting and leadership skills, not on political prowess. Bottom line, all the new COs picked had a knife in their teeth. Simply put, take it one tour at a time and excel in the assignment at hand...

Yes, it is important to continue to seek postgraduate and joint education, but not at the cost of honing your war fighting skills or providing support to our war fighting forces."

-- RADM Gerry Hoewing, Head Detailer for the United States Navy. (Perspective, 1998).

A. BACKGROUND

Undertaking a fully-funded postgraduate education is seen as a career neutral endeavor by the aviators in fixed-wing, carrier-based communities. Statements such as that by RADM Hoewing send a clear message that graduate education is nice to have, but line officers belong in operational billets. Graduate education as it exists in the Navy today is not specifically targeted to improving war-fighting skills or operational know-how. If it did, it would be training rather than education. This fundamental difference between operational requirements which rest in the here and now and the purpose of education which focuses on the future using the past and the present as a guide or means of analysis presents a dilemma for carrier aviators. The fundamental question this thesis seeks to answer is: "Does fully-funded, full-time graduate education hurt one's chances for promotion to Pay Grade 5 and screening for squadron command?"

Aviation, more so than any other line community revolves around the "trigger-pulling" skills of the officers who operate and manage weapon systems in real-time.

1

When the opportunity to attend a full-time graduate program, such as those offered at the Naval Postgraduate School, arises at the officer's first shore tour, many carrier-based aviators prefer to remain close to their operational specialty. This is done through requesting a billet at the Fleet Replacement Squadron, a training squadron in Pensacola, or by seeking assignment to one of the various communities' weapons schools. All of these billets, while shore-based and not 'operational' still allow an officer to continue to fly and build his or her reputation in a community. Often, a two-year tour at the Naval Postgraduate School is followed by a disassociated sea tour. For aviators this means an additional two and one-half years out of the cockpit and away from their operational specialty. In short, a cost-benefit decision must be made from an officer's perspective on the value of advanced education to one's military career plus any long-term benefits for a possible follow-on career in the civilian sector for the individual officer.

B.   PURPOSE

The purpose of this thesis is to analyze the effects that postgraduate education may have on an officer's career. This thesis will further examine the career impacts of types of graduate education, the timing of completing a degree, and the technical specificity of that degree. The effects of earning a graduate degree on the officer's own time versus a fully-funded degree will be examined as well.

C.   SCOPE AND METHODOLOGY

The scope of this thesis will include: (1) a review of aviation career paths; (2) a review of current policies concerning postgraduate education for Naval officers; and (3)

an evaluation of explanatory variables that may predict promotion to Pay Grade 5 or command screen. The thesis will conclude with recommendations for future policies concerning advanced education and career planning for carrier-based pilots and naval flight officers, and recommendations for further research.

The methodology used will consist primarily of estimating multivariate models of the impact of graduate education on an officer's career. The predicted probabilities of promotion/screen outcomes will be derived from binomial logit estimating models.

D. ORGANIZATION OF STUDY

This study is organized into six chapters. Chapter II is a review of pertinent literature, including the human capital model (Becker, 1975) and other models of organizational composition, selection processes, and career progression for aviation officers. Chapter III is an in-depth discussion of career progression for fixed-wing, carrier-based aviators. The Navy's subspecialty system and types of graduate education programs currently available to naval officers are also discussed in this chapter. Chapter IV is a description of the database used in this thesis and includes a further discussion on the human capital model, its relation to graduate education in the Navy and to the promote/screen outcomes used in this thesis. Chapter V discusses descriptive statistics and logit model results and their relevance to the effects of fully-funded graduate education. Chapter VI concludes the thesis with a summary of significant findings, policy recommendations, and recommendations for further research.

THIS PAGE INTENTIONALLY LEFT BLANK

II.   LITERATURE REVIEW

A.   HUMAN CAPITAL THEORY AND BENEFITS OF GRADUATE EDUCATION

Human capital theory is a way of addressing, in economic terms, investment in people. Whether through training, education, or quality of life, human capital theory recognizes that individuals seek to improve their lot in life. There are costs and benefits associated with this type of investment, with factors similar to the costs and returns associated with physical capital.

Human capital theory takes an economic approach towards investment in human beings through on-the-job training, education, information, and health. (Becker, 1962, p.9). The literature shows that various measures of individual productivity within a firm have been applied to this framework. Becker (1962, 1975) used salary and age-earnings profiles, where Wise (1975) suggested that promotion outcomes were a more valid measure of on-the-job productivity. Both methods seek to quantify productivity, as measured through a combination of ability and acquired skill. Human capital predicts a positive correlation between ability, education level, acquired skill and individual productivity over time (Wise, 1975). This section will address on-the-job training, general training, firm specific training, formal education, employee motivation and their relationship to investment made in human capital. General applications of human capital theory to fully funded postgraduate education (FFGE) will be incorporated throughout. For the purposes of this study, FFGE is a full-time, postgraduate education program

5

where officers are completely removed from active participation in their warfare specialty. This distinction is made to differentiate officers with FFGE from officers who may obtain a graduate degree on their own time, in addition to performing the duties of a particular assignment.

1. On-The-Job Training

"Many workers increase their productivity by learning new skills and perfecting old ones while on the job. On-the-job training, therefore, is a process that raises future productivity and differs from school training." (Becker, 1962, p.11) This is similar to the situation of most naval officers. Officers that select into a fully funded graduate program have undergone four or more years of perfecting their war fighting skills, many of which require actual experience to acquire. They have also gained experience in management and organizational skills. An opportunity cost of attending a fully funded program is the separation from the experiential environment. One hypothesis of this thesis is that because the Navy places such a premium on operational experience, extended separation from this environment may be viewed as detrimental to one's career. Certainly for the Navy, education imposes an opportunity cost through loss of personnel to man other critical war-fighting positions, and increases current expenditures in expectation of greater future returns. One study calculated that the cost of educating one officer at the NPS was over $106,000.[1] (Cymrot & Cavalluzzo, 1998). Individuals selected for FFGE are expected to show a future return to the Navy through increased retention, promoting

---

[1] This cost includes an officer's salary and cost of on base housing, in addition to traditional educational expenses.

at a rate equal to their peers not receiving FFGE, filling future billets that require advanced education, and greater productivity in future assignments.

2. General Versus Firm-Specific Training

General training refers to knowledge or skills acquired that apply equally well to both the firm providing it and a variety of other firms. This is the type of training received in most undergraduate degree programs, where skills in accounting, management, or even engineering may apply equally as well to a number of firms. Another good example of this would be the general training received in undergraduate military flight training, where the majority of the syllabus is geared towards basic air work and flying skills, which translate directly to skills used in civilian aviation.

General training makes an individual attractive to a number of firms, and the question becomes, "Why would a rational firm provide general training?" (Becker, 1962, p.13) The answer, according to Becker, is that firms would provide general training only if they did not have to bear any of the costs. The Navy deals with this problem logically by establishing minimum service commitments, designed to fill required positions and recoup initial outlays over time. In the words of Becker, "A contract, in effect, converts all training into completely specific training."(1962, p. 23)

Specific training is training that increases productivity only in the firm providing it. (Becker, 1962). "Completely specific training can be defined as training that has no effect on the productivity of trainees that would be useful in other firms." A large portion of on-the-job training within the military can be considered firm-specific training. Consider the specialized skills of naval flight officers (NFO's). They possess the general

7

skills of aviation, such as communications, navigation, and mission planning. However, their position within the aircraft does not involve actual control of the aircraft. Instead an NFO is a mission specialist, who fills such positions as bombardier, airborne radar controller, or electronic counter measures officer. Unlike those trained as pilots, the NFO's unique mission skills are of little use outside of military aviation.

In discussion of investments in human capital, and specifically training, one must consider the future returns. In the case of a specifically trained naval officer, reducing turnover (increasing retention) is in the Navy's best interest because his or her skills are not immediately replaced, and require continued outlay to fund the training for a replacement. Reducing turnover of specifically trained personnel is not patronage, but necessary to maintain and improve the firm's overall productivity. (Becker, 1962, p. 20). Becker asserts that employees with specific training have less incentive to leave an organization, and conversely, organizations have less incentive to fire them, when compared to employees with general training only.

3. Education as a Form of Training

When an organization controls either a product or an occupation, training that is specific to these ends becomes firm-specific training. Such is the case for graduate education provided by the NPS. In this condition, schooling and work are complimentary. "The development of certain skills requires both specialization and experience and can be had partly from firms and partly from schools." (Becker, 1962, p.25). In fact, one of the characteristics of a quality postgraduate education program is one that uses the practical experience of an individual as a baseline for increasing

8

knowledge. (Cavalluzzo & Cymrot, 1998). The specificity of the degree programs and their relationship to the Navy subspecialty systems, seeks to provide a real-time, military relevant education. In fact, the courses at the NPS often apply civilian methods of operation and theoretical frameworks to topics of concern for military students (Gates, Maruyama, Powers, Rosenthal, & Cooper, 1999). Part of the gain realized by the Navy occurs when these officers return to the fleet with a fresh set of ideas and sharpened analytical skills.

But individuals do not undertake formal schooling without some degree of risk to future returns. Implicit in an individual's decision to undertake formal education are both the immediate costs, and value of future returns.

The immediate costs are the sum of the direct costs of education (books, tuition, fees, housing, etc.), and the indirect costs, such as the earnings foregone and time that could have been spent doing other things. For individual naval officers in FFGE, the direct costs of schooling are not a significant factor. Officer's continue to earn their salary, and in the case of the NPS, are provided on-base housing. However, the opportunity cost is the forgone experience in their warfare specialty. Choosing fully funded graduate education means officers must absorb two years of 'non-competitive' fitness reports; whereas their contemporaries who took shore-duty billets involving flying enjoy the dual benefit of remaining 'competitive' and maintaining operational proficiency.

The future returns of graduate education take the form of increased wages, promotions, and/or broadened opportunity. A naval officer who undertakes fully funded

9

graduate education can be said to value the benefits of future earnings in the civilian sector, or the possibility of future promotions in the Navy. Arguably the Navy has reduced its risk in providing graduate education by sponsoring its own graduate school, screening applicants for not only academic ability, but also future promotability, and by obligating officers to additional service after completion of a degree.

Both the individual and the firm realize benefits from graduate education. The individual realizes a return in the form of increased critical thinking skills and problem-analysis capabilities (Gates, et al, 1999) that serve officers and the Navy throughout their careers. Another benefit is increased employee motivation. The possibility for increased future earnings or promotion, has a motivating effect on individuals. Motivation is difficult to measure, but its effect on productivity is unquestionable. Overall productivity does not depend solely on ability and the amount of time and money invested in training an employee. However, the combination of company investment and employee motivation can have a direct and positive effect on quality and productivity within the organization.

B.   INTERNAL LABOR MARKETS, SCREENING, AND SELF-SELECTION

The following section addresses characteristics of individual behavior and organizational structure that affect graduate education within the naval service.

An internal labor market (ILM) is classified as a firm with limited points of entry, where positions are filled through selection and promotion of individuals already in the firm (Oswald, 1984; Rosen, 1992). Essentially, workers within an ILM have some probability of promotion to higher positions within the firm, with a corresponding

increase in wages. Doeringer and Piore (1971) first classified ILM's in 1966, to classify economies internal to a large organization. They argued that ILM's develop in competitive markets where specific skills are required and where on-the-job training is an essential element of acquiring skills. These characteristics apply to naval aviation, where aviation-specific skill sets are developed by the Navy in undergraduate flight training and refined through operational experience. Within aviation, the initial focus is on acquisition of technical skills. Much time and money is spent to train a naval aviator. Conversely, while managerial duties account for the majority of an aviator's duties in the fleet, these skills are learned primarily through on-the-job experience. An additional component of ILM's is that "work rules become customary through repetition" (Doeringer & Piore, 1971, p. 39) and as such acquire the status of theory-in-use (Schein, 1997.)

Oswald (1984) and Rosen (1992) address several reasons for the existence of internal labor markets. First, some types of production require that some workers watch and direct, while others work. Secondly, within this internal market, workers gain experience and knowledge from producing a product. This provides an experienced pool of lower-level workers that the firm may draw from to fill supervisory positions. Thirdly, through observation of the workers on the job, current ability and future potential within that industry can be assessed. Essentially, this close observation serves as another form of screening individuals for higher positions (Oswald, 1984; Rosen, 1992).

In his analysis, Oswald (1984) arrives at three conclusions. The first is that within internal labor markets, seniors are paid more than juniors. If the wage structure decreased

11

with seniority, it would become more difficult to fill senior positions, since workers would leave halfway through a career to move to an employment sector that paid wages independent of age. Second, some seniors and juniors may be paid more than the marginal value of their product. This, in turn, raises the supply of young recruits who find the probability of future returns attractive. Finally, within his analysis he asserts that workers can quit if they are not promoted.

Finally, Lazear (1995) offers a new methodology for analysis of internal labor markets. While acknowledging the usefulness of human capital theory for analyzing rates of return to the labor side of the market, Lazear suggests that a jobs-based analysis may answer such questions as, "What are the characteristics of jobs that lead to promotion?" or "Do jobs (as opposed to workers in them) display different turnover behavior?" (1995, p. 260). Lazear states that certain jobs could act as 'ports of entry' into which virtually all workers were hired. All higher-level jobs in this type of market were only available to workers who had filled these entry positions. This study includes as part of its hypothesis that key billets exist, prior to the Pay Grade 5 reviews, that act as portals of entry (Lazear, 1995) to higher positions within the Navy. For aviation those portals of entry would be completion of undergraduate flight training and successful tours as a division officer, followed by a successful tour as a department head. This is discussed in more detail in Chapter III.

The system in which military officers work can be considered an internal labor market, marked by a hierarchical structure, that promotes from within. Officers serve in operational assignments where they hone the skills of their specific warfare specialty and

the execution of their production duties are continually assessed and quantified by their immediate supervisors. Working within this structure, all fully qualified officers are promoted to Pay Grade 3, with the first up-or-out point coming at an officer's review for promotion to Pay Grade 4, at approximately the ten-year point in a typical career. Officers make decisions on continuation based on an assessment of periodic reviews (fitness reports), promotion rates for their particular year group, and myriad of other factors, which are beyond the scope of this thesis. However, if an officer fails to promote to the next higher Pay Grade, his or her time in grade is restricted by law, and that officer must eventually seek employment in the civilian sector. (Lazear & Rosen, 1981).

Screening involves a firm's action in selecting individuals for employment, positions, or special programs. Common examples of screens are basic educational requirements, required skill sets, or even fees (Gausch & Weiss, 1981; Salop & Salop, 1976). Self-selection in this case is a term used to describe individual behavior in response to organizational controls and individual tolerance for risk.

An important point to remember when discussing screens within an ILM is that individuals are assessed over various time intervals and only the most able individuals are selected for choice assignments and/or promotion to the next highest position. (Rosen, 1992). It is difficult to measure productivity in a military organization using monetary terms because pay scales are fixed according to rank. However, Rosen (1992) and a 1991 Army study on organizational structure (Jacobs & Jaques, 1991) assert that rank or position is a valid measure of productivity. This is because of the far-reaching effects of

13

decisions made at higher levels in the organization.[2] The increased responsibility at higher positions necessitates screens to ensure the viability of the organization.

Screens tighten as officers achieve higher ranks (Rosen, 1992) partly due to the decision horizon discussed earlier, and also because of the increase in responsibility associated with higher ranks. These screens consider not only performance potential, but also motivation of an officer to realize that potential. (Rosen, 1992).

Self-selection occurs when organizational actors are not ambivalent to these screens, but rather react and adjust their behavior in expectation of passing through a screen to the next level in the organization. The important thing to realize is that officers may tend to respond to perceptions of what the organization values, rather than what is stated or published. This thesis seeks to quantify the behavior of the organization in reaction to graduate education through indirect analysis of the perceived opportunity cost of time away from one's operational community.

The Navy screens officers into FFGE based on promotability, derived from past work experience, and educational background.[3] In the case of academic qualifications, officers must meet a minimum standard. However, past performance is the prime consideration for community detailers. Industry uses screens to ensure that jobs are filled by people with the skills to be productive in those positions. Other considerations are

---

[2] Executive Leadership. One part of this study asserted that the time span to identify a cause and effect relationship between a decision and its effects increases with rank. For example, the time horizon for a decision made by an officer at Pay Grade 3 was 3+ months. General officers' decisions were found to affect actions up to 10 years after the decision point.

[3] OPNAVINST 1520.23B, Subj: GRADUATE EDUCATION. 1 October 1991.

how trainable an individual is, and their likelihood of staying with the firm. (Salop & Salop, 1976). The Navy is concerned with future returns from its officers, so part of the contract for FFGE involves an additional service obligation.

It was stated previously that self-selection is a behavior by the individual in response to organizational controls. Self-selection has also been characterized as a pricing scheme used by a firm to ensure only qualified individuals apply for positions. (Salop & Salop, 1976). The behavioral side is when the individual honestly reacts to an offer after weighing the costs and benefits. Assuming that our naval aviators are somewhere between risk-neutral and risk-averse, then only those officers that expect future returns to equal or exceed current costs will select into fully funded graduate education. This thesis asserts that there is a high degree of self-selection involved in the FFGE decision for aviators. This is due to the opportunity costs associated with a tour away from flying and its perceived effects on one's career. From the perspective of the Navy, the increased service obligation, screening for promotability (potential prolonged service beyond obligation), and screening for minimum academic qualification serve as market controls. This helps to ensure that only motivated individuals, who believe they will benefit from FFGE will select into such a program.

To summarize, screening and self-selection help to ensure that only a certain kind of individual will enter into a fully funded degree program. Officers gain an advanced degree that not only benefits their future service, but also helps them when they eventually enter the civilian sector. The Navy realizes a return on officer retention (Cavalluzzo & Cymrot, 1998) and officers with increased analytical and problem-solving

15

skills. (Gates, et al., 1999). This thesis seeks to provide officers empirically determined information on the probability of realizing a future return on graduate education; essentially quantifying how the Navy values graduate education within a homogeneous group.

C. RELEVANT PAST STUDIES

This section will review several studies that have addressed graduate education and its returns to earnings and future productivity. Additional studies examine the role played by graduate education in the military in general, and in the Navy specifically.

1. A Multivariate Analysis of the Effects of Academic Performance and Graduate Education on the Promotion of Senior U.S. Navy Officers

This master's thesis by T. A. Buterbaugh (1995) analyzed the effects of undergraduate grades and fully funded graduate education on promotion to commander (Pay Grade 5) and captain (Pay Grade 6) in the Navy. The dataset consisted of naval officers from all warfare communities and fleet support communities who appeared before the commander and captain boards between 1981 and 1994. Probabilities for promoting to these ranks were analyzed using ordinary least squares (OLS) and maximum likelihood logit models

In measuring the effects of education on officer promotion, Buterbaugh evaluated data from three time periods. The first, from 1981 to1990, analyzed probabilities prior to the mandated reduction in force. The second, from 1990 to 1994, was analyzed to

16

measure the effects during the actual drawdown. Thirdly, he pooled the period from 1981-1994.

This study separated officers into five warfare communities: surface, subsurface, pilot, naval flight officer, and support. This accounted for differences between the various unrestricted line communities, as well as differences between staff and warfare communities.

Buterbaugh (1995) found that for all officers appearing before the commander promotion board, FFGE increased the chances of promotion from 8.4% in the pre-drawdown period to 9.8% in the post-drawdown period. Those officers designated as scholars (undergraduate GPA greater than 3.2) were 6.7% more likely to promote. Higher probabilities of promotion were observed for officers who were "male, white, graduates of the USNA, are married, or have at least one dependent child." (Buterbaugh, 1995, p. 26). Officers with prior enlisted experience, and officers with degrees in math-intensive or engineering-related undergraduate majors were less likely to be promoted by 14.1% and 1.1%, respectively.

For the captain data set, graduate education lost its significance in the promotion equation during both periods. Undergraduate academic performance, attendance at the USNA, and having dependent children were all positive and significant. Prior enlisted status was significant and negative for promotion to O-6.

The parameter estimates for promotion to commander for the pooled time period found that only surface warfare and fleet support officers benefited from FFGE. Surface warfare officers and fleet support officers with FFGE had an increased likelihood of

promotion to commander of 13.5% and 23.4%, respectively. Of the pilots eligible for promotion to commander, whites, those with high undergraduate grades (>3.2), USNA graduates, married officers, and those having at least one dependent child were more likely to promote in the pre-drawdown period. Those with FFGE were more likely to promote, but the effect was not significant. Prior enlisted service, and technical undergraduate majors had statiscally insignificant coefficients. For naval flight officers, being a USNA graduate, and having at least one dependent child had a positive and significant effect in promotion. FFGE, prior enlisted service, and technical undergraduate major has an insignificant effect.

Buterbaugh's thesis demonstrated the aggregate positive effects of undergraduate academic achievement and graduate education on promotion to commander and captain. He did discover variations in this effect, however, for different warfare communities and during different time periods. When analyzing data on separate warfare communities, only surface warfare and fleet support showed significant (and positive) effects for graduate education on promotion to commander. Undergraduate achievement was significant and positive for pilots at the commander promotion board.

The Buterbaugh study is fairly comprehensive in its analysis of the effects of FFGE on the various restricted and unrestricted line communities in the Navy. However, his treatment of communities may miss some of the effects of selection, community values, and differences between sub-cultures within a specific community.

2. The Impact of Fully-Funded Graduate Education and Resident JPME on Aviator Promotion and Command Selection.

This master's thesis by M. S. Orzell (1998) analyzes the effects of graduate education and resident joint professional military education (JPME) on aviator promotion and command screen outcomes. This study uses O-5 and O-6 promotion history files from fiscal years 1986 to 1994.[4] Orzell restricted his data set to include officers that appeared before the O-5 and O-6 promotion boards due to the limited number of officers that had received Joint Professional Military Education (JPME) as O-4s. He also restricted the dataset to include only naval pilots and naval flight officers due to their similar training requirements and similar career paths.

The thesis examined the effects of JPME and fully funded graduate education during two time periods. The first was from 1986 to 1990. The second was from 1990 to 1994. This was to assess the effects of the two programs both before and after the 1990 mandated reduction in force to see if there was any change in promotion or command screen outcomes. Orzell's study incorporated two new variables, which classified officers who held good jobs, as measures of officer performance. Orzell identified several key positions in Pay Grade 3 and Pay Grade 4 that he hypothesized would have a positive effect on an officer's fitness report.[5]

---

[4] Dr. William R. Bowman of the USNA constructed the original dataset.

[5] Examples of good division officer jobs were Training Officer and Quality Assurance Officer. Good department head jobs were defined as the Maintenance Officer and/or the Operations Officer.

a. *Promotion to Commander Results*

For promotion to commander in the pre-1990 dataset, FFGE was positive and significant, increasing the likelihood of promotion to commander by 6.0%, holding all other variables constant. However, the impact of FFGE in the post-1990 dataset was insignificant. JPME was significant and positive in its effects on promotion to commander for both periods. In both periods, pilots were more likely to promote to commander. Pilots were also more likely to attend FFGE and receive JPME (Orzell, 1998). It is interesting to note that the two variables for 'good division officer jobs' and 'good department head jobs' were insignificant in both periods.

b. *Command Screen Results*

Orzell's logit model only analyzed those commanders who stayed to the captain promotion board. The author acknowledges this model may not capture the true effects of FFGE or JPME on command screen, due to the selection bias introduced by officers who might choose to leave the Navy after a tour as a squadron commanding officer. This model found that FFGE was negative in both periods, but the effect was only significant in the pre-FY90 period. Being a pilot had a positive and significant effect on command screen in both periods. The good job department head variable becomes significant and positive in this model for both periods, indicating the value of holding key positions on screening for command.

c. *Promotion to Captain Results*

Orzell found that having held a squadron command billet was the only variable significant and positive for both time periods in explaining O-6 promotion outcomes. The pre-FY90 model found that percent of times recommended for accelerated promotion on O-5 fitness reports and having served as a squadron commander were positive and significant predictors of promotion to captain. The effects of FFGE and JPME are insignificant for both periods.

Orzell used the notional person technique to calculate the marginal effects of various variables on performance outcomes. The commander model showed that FFGE increased the likelihood of promoting to O-5 by 6.0% in the pre-FY90 period, holding all other variables constant. Receiving JPME increased the chances by 6.8% and 7.9% for the pre- and post-FY90 periods, respectively. Marginal effects of the command screen model showed that filling the 'good department head jobs' increases the chance of promotion by 17.5% to 20.0% for the periods analyzed, and that FFGE decreased the chances of screening by –6.4% to 4.4%, pre and post-FY90 respectively. One interesting finding is that pilots were shown to have a distinct advantage over naval flight officers at the command screen board by just over 17% in both periods. For the promotion to captain model, only a variable indicating previously having a command tour was significant; it increased the likelihood of promotion to captain by 81.9 percent. The author acknowledges that a large part of the variation in the model is dominated by this result.

21

Orzell's approach to assessing the effects of graduate education has several unique aspects. He has sorted the data to include a group of people with similar entry-level training. This sorting also accounts for differences in the opportunity costs of fully funded graduate education between warfare communities. His model builds on the Buterbaugh (1995) thesis but includes an analysis of the effects of the drawdown in the early 1990's and incorporates variables for key billets in the organization. Although not designated as such, his variables for good jobs seem to act as proxies for ability and motivation and address a key difference in the detailing procedures between aviation and the other unrestricted line communities. This thesis did not consider the timing or utilization of graduate education. Orzell suggests that distinction between the land-based maritime patrol, rotary-wing, and tactical aviation communities may reveal different results. The model for command screen used data from officers who had appeared before the captain promotion boards. It is possible that this method does not account for officers that filled commanding officer billets and then chose to leave the Navy. A possible effect of this specification is that the effects of graduate education on command screen may be understated.

3. Graduate Education and Employee Performance: Evidence from Military Personnel.

This study by Professors William Bowman and Stephen Mehay (1999) analyzed the effects of a master's degree on the probability of promotion to Pay Grade 4 for naval officers. The dataset consisted of line (operational) and restricted line (staff) naval officers who were reviewed for promotion to Pay Grade 4 between 1985 and 1990,

representing officers who entered the Navy between 1976 and 1980. The dataset is similar to the dataset used in this thesis.[6]

Bowman and Mehay used bivariate probit models to estimate the effects of graduate education on promotion. They used a human capital model that defined an individual's promotion probability as a function of the aggregate promotion rate for a given year, the individual's effort and ability, and the efforts and abilities of all others in the same Pay Grade. Initial unadjusted promotion differentials showed that line officers and staff officers with a master's degree promoted at rates 10 and 14 percent greater than officers without degrees respectively.

For line officers in this study, bivariate probit models without controls for ability or job performance showed that the effects of a fully funded degree increased the likelihood of promoting by 14.8 percent. Once controls for ability and performance were introduced to the model, effects of a degree for line officers were reduced by 5.5 percent. However, the coefficient still indicated that graduate education increased the likelihood of promotion by 7.4 percent.

Separate estimates were run on the choice (or selection) to attend graduate school to better estimate the effects of graduate education and account for selection bias. Controls for different communities were included in the model, along with proxies for academic ability, early career performance, stated preference for graduate education, and individual characteristics such as age, gender, and minority status. Bowman and Mehay

---

[6] Prof. Bowman compiled the original dataset for this thesis, with only minor modifications made by the author.

found that line officers, hypothesized to have the highest opportunity costs of attending fully funded education, were less likely to enter a fully funded program than staff officers. This led the authors to conclude that a large part "of the positive relationship between master's degrees and promotion were due to unobservable attributes [such as motivation] that lead some people to attend (or be selected for) graduate school...and to be more promotable."

The Bowman-Mehay study provides a positive evaluation of graduate education in the Navy. However, several issues that may affect the returns to graduate education were not considered. The first is inherent differences between career paths (e.g., time-to-train) of specific line communities. The timing, technical specificity, and utilization of a degree are not addressed by this study. Finally, promotion to Pay Grade 4 is a good intermediate measure of productivity, but does not address the time period where officers would apply the skills acquired through a master's degree in their respective communities. This study provides a framework for analysis of graduate education in the Navy and allows for further, more community-specific research.

4. A Bottom-Up Assessment of Navy Flagship Schools

The Center for Naval Analyses (Cymrot & Cavalluzzo, 1998) evaluated the effectiveness of the Navy's flagship educational institutions; namely, the United States Naval Academy, the Naval Postgraduate School, the Naval War College, and the Armed Forces Staff College. The study was undertaken to address the future ability of the schools to provide top-quality education in the face of budgetary reductions and future force drawdowns.

The study first looked at key attributes of top-tier academic institutions, as determined by independent accreditation organizations and assessed the quality of Navy schools against those attributes. It also reviewed current and projected funding required to maintain a quality educational system and incorporated a comparison with other similar institutions, both in and out of the Department of Defense. The outcomes addressed, in terms of return on investment, are analysis of retention, utilization, and promotion of officers who participated in fully funded educational opportunities at these institutions.

The primary analysis used unadjusted mean percentages of various outcomes. This method may capture raw data; however, it does not account for the interactions between key factors, such as differences in backgrounds, or variances in fiscal environments.

This review will focus on the findings related to postgraduate education in the Navy. It will begin with the characteristics of top-tier institutions to address what people are expecting from top-notch graduate education. Secondly, the issue of how the navy realizes a return on its investment in human capital through utilization, retention, and promotion will be addressed. This section will conclude with the recommendations on the NPS's graduate program format, follow-on utilization of officers, and implications for the future of advanced education within the Department of the Navy.

a. *Characteristics of Top-Tier Educational Institutions and The Naval Postgraduate School*

Cymrot contrasted the accreditation process and requirements to arrive at several indicators of quality postgraduate education. According to the Center for Naval Analyses' research, quality graduate programs exhibit several of the following (Cavalluzzo & Cymrot, 1998, pp. 18-19):

1) Unity of purpose among faculty, students, and administrators.
2) Cooperation and support among program participants.
3) Rigorous program requirements, including core courses, intense immersion learning situations, hands-on learning experiences, and a substantial product, such as a thesis or final project.
4) Institutional and departmental support. Specifically in the way of funding activities geared specifically towards the master's program, vice institutional research, doctoral programs, or undergraduate studies.
5) Faculty involvement
6) Committed students with diverse backgrounds and experiences. The study defines good students less in terms of academic qualifications than in level of commitment and motivation to enhance the overall educational experience.
7) Strong program leadership. The authors classified this as a management approach that values diversity, makes the most of resources, is skilled at recruiting and retaining top-notch faculty.

The NPS was determined to exhibit several of these qualities but one must recognize that the NPS is different from other institutions that offer advanced education. First and foremost, NPS is a stand-alone, graduate institution that: 1) specializes in graduate education, 2) is focused on a curriculum that offers firm-specific education to support the sub-specialty requirements of the Navy, and 3) is targeted to mid-careerists, five or more years removed from academia, but who have gained much in the way of practical leadership, management, and technical skills. It is from this framework that Cavalluzzo and Cymrot chose their performance outcomes. These were: 1) Utilization

rates in designated billets, 2) Continuation rates of graduates, 3) Selection to advanced ranks and, 4) Representation at flag rank.

The first outcome was the utilization rate of graduates. The study looked at all naval officers, without regard to community. It found that while 67 percent of graduates served a utilization tour, only 30 percent filled a billet that exactly matched their subspecialty, and that a substantial amount of time had passed between completion of the degree and utilization.

Continuation rates and promotion were chosen as the second outcome. The study found that NPS graduates were more likely to stay in the Navy and also more likely to promote to Pay Grade 4 than officers without graduate degrees.

Finally the study found that as of September, 1996; 80% of flag officers had a master's degree or higher. However, only 28% of flag officers had received their degree from NPS.

b. C.N.A.'s Recommendations

The authors assert that given the infrequent assignment to matching billets, that a more generalized postgraduate education may be more effective for meeting the advanced education requirements of naval officers. The outcomes of less firm-specific advanced education would be a reduction in costs associated with curriculum development and maintenance.

They also suggest that the Navy could reduce the level of detail in defining the sub-specialty requirements (which in turn drive curricula composition). More generalized requirements would allow for greater consideration of civilian alternatives

27

and introduce competition, providing incentives for the Naval Postgraduate School to find more efficient alternatives for providing advanced education.

It is interesting to note that the authors suggest a "Master of Science in Military Management and Technology" that would offer a curriculum more tailored to the immediate needs of its graduates. One such program currently exists, run by the Naval Postgraduate School, at the United States Naval Academy. A small group of officers receives one year of intensive instruction, earning a Master of Science in Leadership and Human Resources Development. At the completion of the degree, these officers immediately serve as company officers at the Naval Academy, completing their utilization tour and giving practical application to newly acquired skills.

III. CAREER PROGRESSION AND GRADUATE EDUCATION

This chapter will discuss the career progression of fixed-wing, carrier-based naval aviators and conclude with a review of the graduate education system in the Navy. A naval career is a finite event, even for those who reach the highest levels of the military hierarchy. An officer within this system must promote, or eventually accept retirement or separation. Accessions into naval aviation occur primarily at entry-level positions, with a small amount of accessions occurring through early transfers of junior officers from other naval communities. This being said, a career within naval aviation follows a predictable course, with some time-to-train differences between carrier-based, land-based maritime patrol, and rotary-wing communities. This chapter will address the career progression of fixed-wing, carrier-based aviators, officer fitness report evaluations, promotions, and screening for command of a squadron. The second part of this chapter will address the graduate education system in the Navy as it exists today.

A. CAREER PROGRESSION

Initial entry into the aviation community is based on strict physical standards and a combination of academic achievement and batteries of aptitude tests. Applicants may not be older than 27 years of age upon acceptance to the flight program. The flight program is extremely competitive. An officer that receives less than 80 percent on a ground school test, or fails to perform satisfactorily on a flight event, receives a failure, or a 'down'. The current standard is three failures and out. For the period 1988-1992, the

overall attrition rate for Navy and Marine Corps pilots was 20.3 percent.[1] Flight students desiring to fly fixed-wing aircraft[2] from the decks of aircraft carriers face high levels of competition throughout undergraduate flight training. Only those students with the highest ratings are permitted to select carrier-based aircraft.

Aviators spend a large portion of their early career in various training squadrons to acquire the skill sets necessary to operate complex machinery in a dynamic environment. Throughout the world of aviation, no environment is more complex than operating from the decks of an aircraft carrier. As such, training pipelines for naval aviators selected for carrier duty are longer than those selected for land-based maritime patrol or rotary-wing aircraft by one to four years.[3] An aviation officer's career begins with approximately two years in undergraduate flight training, learning the basic skills of aviation. Pilots take about a year longer than naval flight officers, due to extra time in the pipeline devoted to learning how to land on an aircraft carrier. At the completion of undergraduate flight training, an aviator earns his or her gold wings and is designated a naval aviator or naval flight officer. The prospective fleet aviator[4] is then sent to a fleet replacement squadron (FRS) to qualify in the operational aircraft of their new community. This is the first time an aviator operates an aircraft designed for war-fighting

---

[1] See "Career Progression of Minority and Women Officers." Office of the Under Secretary of Defense, August, 1999, p.53.

[2] For the remainder of this study, the term 'carrier-based aircraft' will be used to represent the various jet communities as well as carrier-based propeller driven aircraft, i.e. the E-2C Hawkeye.

[3] "Naval Aviation Production Process Improvement (NAPPI): Background/Talking Points." Available at <www.hq.navy.mil/Airwarfare/navysite/Talking%20Points%20for%20NAPPI%20032699.htm>.

[4] The term 'aviator' refers to both pilots and naval flight officers unless specified otherwise.

use. Along with learning the various aircraft systems and weaponry, the pilots must also re-qualify aboard an aircraft carrier, and for the first time, qualify in night landings. Up to two months of dedicated preparation goes into this final certification for each pilot. Naval flight officers are exposed to the carrier for the first time during these qualification periods. At the completion of the FRS syllabus, about one year in length, aircrews are completely qualified to enter the fleet. Often they are immediately sent to meet squadrons already on deployment around the world. This process, when running at an optimal pace takes about three years for a pilot and two years for a naval flight officer. Realistically, there are many delays in the training pipelines and the time from commissioning to fleet squadron has taken as long as five years.[5]

It is important to recognize that up to the point that officers join their first operational squadron, all of their training is application of cognitive skills. They are learning tasks and acquiring physical and mental skills that relate directly to the operation of aircraft. But when officers enter their first fleet squadron, they are expected to be naval leaders as well as aviators. It is at this point that their fitness report summaries begin to reflect the affective as well as cognitive skills of an officer. Affective skills can be thought of as those skills that enable a person to get along within the organization, such as leadership ability, motivational skills, and organizational skills.

Table 3.1 shows a typical career path for aviation, recognizing that careers vary with each officer. The initial fleet squadron assignment is termed sea duty. Sea duty is

---

[5] According to an analysis by the Thomas Group, Inc. as part of the Naval Aviation Production Process Improvement (NAPPI) program. Available at <http://navaltx.navy.mil/cnatra/>.

time spent in an operational command. During sea duty, squadrons typically deploy for six months at a time and work at an increased pace. After an officer spends two to three years on sea duty, it is now time for that officer to rotate to a billet in a command based ashore. This is termed shore duty. Prior to the first shore duty rotation, an officer must make a decision on what kind of shore duty to accept. Many billets, whether sea or shore-based have the potential to help, hinder, or hurt an officer's career. It is at this point that the first window of opportunity is available for an officer to pursue fully funded graduate education. Table 3.1 lists the sequence and lengths of the various sea and shore rotations available in a typical aviation career path. The length of time for sea duty is proscribed, due to the primacy assigned to filling war-fighting billets in sea-going commands. Shore tour lengths are recommended and highly flexible in their duration. This is evidence of the value the Navy places on operational tours and is in line with the military's emphasis on combat readiness.

Table 3.1 -- Aviation Officer (13XX) Proscribed Sea Tour Lengths and Recommended Shore Tour Lengths.

Rank: (Pay Grade)	Tour	Description	Sea (Months)	Shore (Months)	Total Years (approx.)	Remarks
ENS: (O-1)	Undergraduate flight training	Pilot/NFO Training	N/A	24	0 2	
LTJG: (O-2)	FRS training	Initial fleet aircraft training		12	3	
LT: (O-3)	Initial sea tour	Initial fleet squadron assignment	24-36		6	
LT	First shore tour	TRACOM, FRS, **PG School**, Staff, CRUITCOM, etc.		24-36	9	
LT	Second sea tour	Squadron, Ship's Company, Embarked Staff	24		9-11	
LCDR: (O-4)	Third sea tour	Squadron Department Head Tour	24-30		10-11	May be reduced to 24 months for O-5
CDR: (O-5)	Second shore	Staff, Joint, Washington D.C., **Subspecialty**		24-36	14	Variable by community demand.
CDR	Sea	Command XO/CO tour	24-36		17	
CDR	Shore	Post-Command		36	18-20	Variable with billet and individual situations (e.g., bonus or sequential command select

Note. From the U.S. Navy Officer Transfer Manual, Change 3-99, p. 3-13.

Note that the first opportunity for full-time graduate education comes around the six-year point. Subsequently, a utilization tour for that degree would occur at the 14-year point in a typical career (usually after the officer has completed a tour as a department head).

The hierarchical structure of the military applies to naval aviation as well, and implies increasing levels of responsibility with each increase in an officer's rank (or Pay Grade). Reviews of officers' performance occur at fixed intervals and if performance is judged to be less than that required for future positions, an officer is not promoted. If an

officer twice fails to select for the next higher Pay Grade, then he or she must eventually leave the service. (Lazear & Rosen, 1981; Bowman & Mehay, 1999).

1. Periodic Reviews

Selection boards review an officer's performance at various stages in a career. The Navy convenes selection boards to screen officers for promotion, special programs, or key positions. Promotion boards are established by law, with tight limits on percentages of officers that may be promoted. Administrative boards are used to select officers for special programs or key billets.

Promotion to Pay Grade 2 and Pay Grade 3 are virtually automatic, as these officers are still in the initial phases of their career and make up the bulk of the operational force. The Navy's current policy on promotion to Pay Grades 2 and 3 is to promote all fully qualified officers. The Pay Grade 4 review, at roughly the ten-year point, is the first competitive review an officer faces. This is the first up-or-out review and if an officer does not promote, a career with the Navy is essentially over. At these boards, officers from the three major warfare communities (surface, submarine, and aviation) review an unrestricted line officer's performance record. This means that all unrestricted line officers are reviewed as a group. So a surface warfare officer may review an aviator's record when being considered for promotion.

Administrative boards are used to select for special programs, such as test pilot school; or key positions, such as squadron command. In the case of the screen for squadron command, the board is composed of aviation officers only and occurs shortly after the Pay Grade 5 board is complete. Command screen boards occur each November.

34

Another form of an administrative board is the screen for funded graduate education. These are primarily ad hoc boards that select/screen officers for minimum academic qualifications and future promotion potential.

2. Fitness Reports

Officers receive periodic evaluations (at least one per annum) of their performance by their immediate superiors. Officers receive an 'observed' fitness report if they have been closely observed for a majority of the time covered by a reporting period. They receive 'unobserved' reports for times not under close evaluation in an assigned billet, to provide for a day-to-day accounting of one's career. Time spent in various training and educational environments, such as flight school or in a full-time graduate education program are treated as unobserved time in an officer's career.

Fitness reports are used to characterize an officer's performance. For the time period of this study, officers received letter grades in 14 different categories, ranging from managerial capabilities to warfare specialty skills. It was common practice for an officer to receive all A's in these categories, with the real distinguishing features between officers expressed in paragraph form on the back of the fitness report. Summary remarks stated accomplishments and achievements during the reporting period, as well as indications of future promotability and potential. Another discrimination element on the report was the officer's recommendation for promotion. This could be 'early,' 'regular,' or 'not recommended.' This recommendation, combined with the written summary, traditionally carried more weight than the often-inflated category grades.

This study uses percentage of times recommended for accelerated promotion in Pay Grade 3 (PRAP3) as an independent variable in the promote/screen equation. Only fitness report evaluations where officers were competitively ranked against their peers were considered valid when deriving the PRAP3 variable. Fitness reports received when detaching a command, any 1 of 1 ranking, and reports received while in training or schooling assignments were disqualified to ensure a more accurate representation of performance.

The Navy uses highly centralized control for its promotion boards, and relies almost exclusively on the officer's fitness report when considering officers for promotion or special programs. However, much goes into a superior's evaluation of an officer, and commanding officers are careful to select only the most capable officers for key positions within their command. This especially applies to aviation squadron department heads, where an officer is generically assigned to a squadron. The commanding officer determines what billet within the squadron a department head will fill rather than an administrative board or a community detailer. This is a key difference from the surface warfare and submarine communities where officers are 'detailed' to specific department head positions.

The fitness report contains quantified achievements in the summary, but the ranking is usually subjective on the part of the reporting senior. In essence, the entire fitness report is an evaluation of an officer's cognitive and affective skills and their relevance to current and future positions.

3. Promotion Board Guidelines

Department of Defense regulations dictate the percentages of officers that may promote, as well as the time in service that promotions should occur. Table 3.2 shows the guidelines as of June 1996. These percentages refer to aggregate of unrestricted line officers, and may vary by designator and specific warfare community (within aviation, Attack and Fighter are examples of two different communities.)

Table 3.2 -- Desired Active Duty List Promotion Timing and Opportunity

TO GRADE	TIMING[1]	OPPORTUNITY
O-4 (Pay Grade 4)	10 years +/- 1 year	80%
O-5 (Pay Grade 5)	16 years +/- 1 year	70%
O-6 (Pay Grade 6)	22 years +/- 1 year	50%

[1] Years of commissioned military service plus all entry grade credit.
Note. From Department of Defense Instruction 1320.13, Enclosure 2, June 21, 1996.

Once convened, promotion boards operate under directives that govern communications and items they may consider for review of an officer's record. For example, Boards are forbidden from considering an officer's marital status, or the "employment, education, or volunteer service of a spouse."[6] Boards are directed to select officers using a "best and fully qualified" benchmark. Fully qualified means that an officer must be capable of performing at the next higher rank. Consideration is given to minority status; however, promotion quotas are not in effect. Boards are encouraged to acknowledge institutional barriers or decreased opportunities for minorities to hold key positions and again consider the actual performance and not the billet filled. The

following guidance on graduate education was given to the FY-01 Pay Grade 6 promotion boards:

> "Post-graduate education and specialty skills, represented by proven subspecialties, are important to our Navy and represent a key investment in our future. The Navy needs officers with formal technical and military education in a time of increasing technological sophistication. Advanced education achievement is a significant career milestone in the development of future Navy leadership. The utilization of advanced education in subspecialty tours is an equally significant career milestone. In determining an officer's fitness for selection, you shall favorably consider graduate degrees, military education, and experience in specialized areas." (FY-01 Active Duty Officer Promotion Selection Board Guidance, Appendix B, p. 3).[7]

Even with a strong statement to the board, there are no requirements to promote officers with graduate education at rates equal to their peers lacking graduate degrees. In contrast, for officers serving in designated Joint Duty Assignments, officers designated as Joint Specialty Officers, or officers serving in other joint assignments the board is encouraged to achieve promotion rates equal to officers serving in Navy staff positions. The difference is minor, but recommending a percentage to a promotion board sends a stronger message than a statement of validity.

4. Squadron Command

The high point of any career traditionally is to be selected for command. It is to this end that a career-minded junior officer aspires. Command of a squadron represents

---

[6] "FY-01 Active Duty Officer Promotion Selection Board Guidance." Available at <http://www.bupers.navy.mil/pers8/p85/p85l/o6.htm>.

[7] Available at <www.bupers.navy.mil/pers8/p85/p85l/o6.htm>.

the culmination of an aviator's operational career. Selection is based on a summary review of an officer's performance and his or her current and future capabilities. Officers can expect to report to their command tour around the 17-year point in a career. The typical tour lasts from 24 to 36 months. Carrier-aviation handles the command screen differently from the surface or submarine communities. Officers are first screened for command, and then report to their squadron as the executive officer. Officers will first serve as executive officers for 12 to 18 months, then turnover with the current commanding officer and begin the actual command portion of their tour.

Commanding officers of squadrons are the central point of authority and leadership for the 200 or more personnel entrusted to their care. For many carrier-based aviators, squadron command is their last tour in a billet that involves flying. Some post-squadron-command flight billets exist in the form of bonus commands, such as the commanding officer of the FRS, but these are rare. However, the majority of commanding officers go on to fill various senior staff and planning positions in the Navy. Essentially, squadron command is their last hands-on involvement in war-fighting billets.

B.   SUBSPECIALTY MANAGEMENT

Before any discussion of fully funded graduate education, one must first understand the structure of the current subspecialty system and its relationship to advanced officer education. The subspecialty system serves as justification for the various programs offered by the NPS. Some studies question the validity of the current system, due to the traditionally low utilization rates among URL officers (see for example: Cavalluzzo & Cymrot, 1998). The system as it currently exists does not capture

(nor does it attempt to capture) the effects of graduate education for officers. In the fleet, unrestricted line officers 'specialize' in their designated warfare positions. The yardstick these 'warrior' officers are measured by is their performance in sea-going, operational billets. The subspecialty system was never meant to capture the benefits a graduate degree may provide during operational tours, and as such cannot be expected to serve as full justification or rebuttal for the graduate education system.

1. Subspecialty System

In the Navy, a subspecialty code (or P-code) designates expertise in an area other than one's primary occupational specialty. These subspecialty codes are tied to a set of educational skill requirements for a particular billet. For example, a billet for a comptroller may require an officer with a P-code of XX32 (Financial Management).

There are numerous ways to earn a subspecialty code. The primary way is through completing a specified course of study at the Naval Postgraduate School, which results in the awarding of a P-code. Another way for officers to receive a subspecialty code is to serve in a billet that requires a specific subspecialty-designated skill. At the completion of assignment to that particular billet, the officer would earn an R-code, similar to the P-code designation obtained through postgraduate education. This occurs within critical billets, for which no P-coded officer is available for assignment. It is also possible to earn a P-Code if a degree completed on the officer's own time fulfills the educational skill requirements of a particular subspecialty.

As stated previously, the NPS is the primary assignment activity for officer subspecialty codes. Each course of study at NPS has a DOD sponsor, which requires that

course's particular subspecialty code for various billets under their cognizance. By law, the NPS cannot offer a course of study unless it directly complements billets within the DOD. This is one of the reasons for the high-level of firm-specific education offered by the NPS.

2. Subspecialty Utilization

According to the Officer Transfer Manual (OTM), upon completion of fully funded graduate education, an officer should be assigned to a utilization tour at the first opportunity. Currently the Navy interprets this to mean within two shore tours, whereas other services consider the two tours of duty immediately following completion of graduate education. The assignment to a utilization tour is not to preclude assignment to key operational billets in order to meet career milestones such as department head, executive officer, or command tours. Following a FFGE tour, the assignment policy makes an allowance for aviators to meet flight time requirement gates by designating that assignment to operational tours should be Duty Involving Flight Operations (DIFOPS). This is to avoid penalizing officers for time out of the cockpit while undergoing FFGE. (OTM, 1999).

Officers fulfill the requirement for a utilization tour by serving in a P-coded matching billet. A direct match is desired; however, numerous billets carry primary and "closely related" subspecialty designations. Additionally an officer may fulfill the requirement by serving in a "billet utilizing (an) officer's subspecialty in a billet that is not subspecialty coded," or serving in a billet with a "higher priority requirement." (Officer Transfer Manual, 1999, pp. 7-13). The Center for Naval Analyses found that as

of the fall of 1994, only 30% of unrestricted line officers filled a billet that exactly matched their subspecialty code. Another 21% filled a closely matching billet and an aggregate of 67% ever filled a subspecialty billet at all. (Cavalluzzo & Cymrot, 1998).[8]

This thesis found the aggregate utilization rate among carrier-based fixed-wing aviators was only 38.5 percent. The point of measurement for utilization is prior to the Pay Grade 6 board, which would encompass the two sea-tour window. This figure calls attention to how difficult it may be to fit a utilization tour into a competitive career path.

3. Selection for Fully-Funded Graduate Education

Each officer applying for FFGE is administratively screened and then reviewed by a board for selection to postgraduate education programs. Selection is based on "academic capability, outstanding professional performance, promotion potential, and a strong academic background."[9] Academically, minimum standards are set for each course of study at the Naval Postgraduate School. It is to this end that the Navy uses the Academic Profile Code (APC) to characterize an officer's undergraduate grade point average, math ability, and technical qualifications (see Table 3.3).

Table 3.3 -- Academic Profile Codes

APC1	Quality Point Rating Code
Code	Quality Point Rating (GPA)
0	3.60-4.00
1	3.20-3.59
2	2.6-3.19
3	2.20-2.59

---

[8] These percentages account for NPS graduates only. Other Navy sponsored graduate programs were not considered.

[9] OPNAVINST 1520.23B, Graduate Education, 01 October 1991.

4	1.90-2.19	
5	0-1.89	
APC2	**Math Qualification Code**	
0	Significant post-calculus math with B average	
1	2 or more calculus courses with B+ average	
2	2 or more calculus courses with C+ average	
3	1 calculus course with C grade or better	
4	At least 2 pre-calculus courses with B average or better	
5	At least one pre-calculus course with C grade	
6	No math with C grade	
APC3	**Technical Qualification Code**	
	Lower Division Calculus-Based Physics	Upper Division Courses in Engineering/Physical Science Major
0		B+ average
1		C+ average
2	Complete sequence taken, B+ average	
3	Complete sequence taken, C+ average	
4	At least one course with C grade	
5	None	

<u>Note.</u> From the Manual of Navy Officer Manpower and Personnel Classifications, Volume II, 1992.

The academic profile code (APC) maintained in an officer's service record is a three-digit code which describes overall undergraduate academic achievement, technical coursework performance, and technical specificity of academic major. Each Navy-funded graduate education program has a minimum APC requirement. For example, an officer desiring a master of science in aeronautical engineering requires a minimum APC of 3-2-3 for direct entry. This means the officer at a minimum requires a 2.60 undergraduate grade point average, two or more calculus courses with a C+ average in those courses, and a complete sequence of lower division physics course with a C+ average.

Only one program at the NPS requires an undergraduate grade point average greater than 2.20/4.00 (APC1 code less than 3) and that is for the Reactors/Mechanical

Engineering curriculum. It is important to note that the NPS is a school oriented to the needs of naval officers. Special programs address the fact that naval officers are adult learners, four or more years removed from an academic environment. If an officer's math or technical qualification code does not meet curricula direct entry requirements, or a significant period of time has elapsed since college, the school offers a six to twelve week "engineering science" refresher curriculum to prepare students for graduate level coursework. Figure 3.1 below groups officers by graduate degree status. The categories are NOGRAD, or officers without graduate degrees; PARTGRAD, or officers who obtained a graduate degree on their own time; FFNTECH for officers who earned a non-technical graduate degree in a full-time program; and FFTECH for officers who earned a technical graduate degree in a full-time program. When one compares the various AP codes of the officers in this study (see Figure 3.1 below), there is actually little differentiation from one group to the next. The surprising exception is for those officers selecting into the fully-funded non-technical programs (FFNTECH). These officers have better undergraduate grades, better math scores, and better technical ratings than any other comparison category (note that lower APC's are 'better').

Mean Values of Academic Profile Codes by Graduate Degree Status (n=1,522)

Mean APC

	NOGRAD (n=892)	PARTGRAD (n=396)	FFNTECH (n=122)	FFTECH (n=112)
APC1	3.0	2.7	2.2	2.5
APC2	3.5	3.3	2.0	3.0
APC3	3.8	3.6	2.2	3.7

Type of Degree
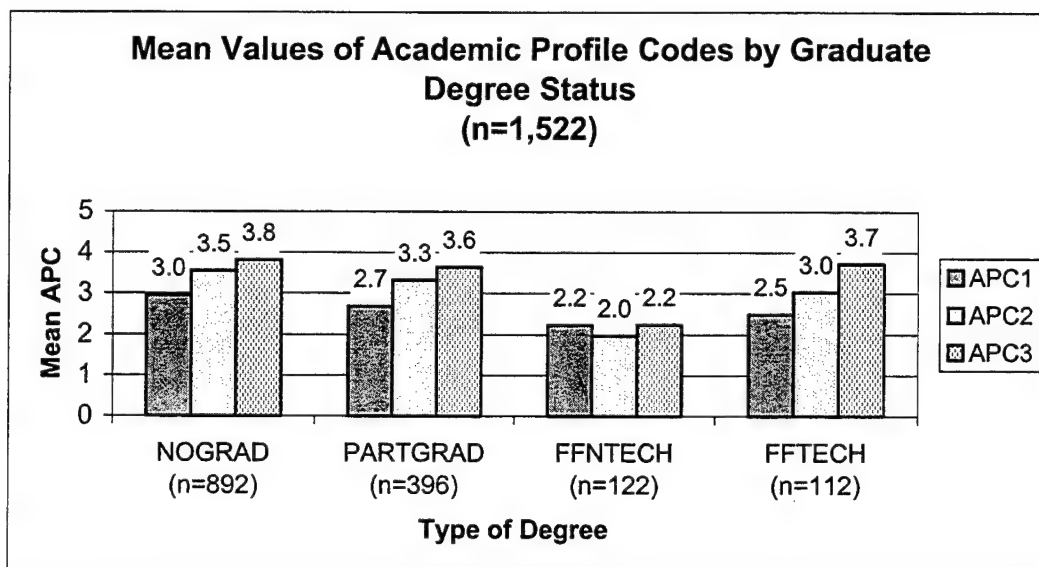
Figure 3.1

The point to realize is that an officer does not need to be an engineer, or have a highly technical undergraduate background to successfully complete a graduate degree. These programs are designed for officers with proven performance in their operational specialties and offer a unique opportunity for expanded intellectual pursuits.

4. Obligation

Upon completion (or termination) of the education program, officers obligate for a period of three years for the first year of graduate education and one month for each month thereafter. This obligation is served concurrently with any other obligations incurred, vice consecutively.[10] On average, an officer will obligate for four additional

---

[10] "Concurrent" means that the graduate education obligation may be served at the same time as serving the initial obligation for aviation training, for example.

years of service (three years for the first year of education, then one year for each following year of education) upon the completion of a graduate degree.[11]

C.   GRADUATE EDUCATION AVAILABLE TO NAVAL OFFICERS

Since the founding of the Naval Postgraduate School in 1909, the Navy has recognized a need for advanced education for its officers. At the time, new propulsion and weapon systems for ships highlighted the need for an officer corps with elevated levels of technical skills. The Navy has faced issues of developing and integrating emerging technologies since the introduction of the steam plant in the late 1800's. Today's Navy may have a different face, but the need for highly educated officers remains. This section will address the various means for naval officers to obtain a graduate education. In the promote/screen data set used in this thesis, 453 (24.9%) officers earned graduate degrees on their own time and 325 (17.9%) officers earned degrees through a full-time program. Table 3.4 below displays the breakdown by promotion fiscal year of officers who received various types of graduate degrees.

Table 3.4 – Count and Percent of Graduate Education Status by Promotion Board Fiscal Year

Grad Ed. Status	PROMOTION BOARD FISCAL YEAR									
	81	82	83	84	85	86	87	88	89	Total
None	251	121	121	100	103	120	99	86	38	1039
	61.2%	55.3%	53.8%	60.6%	59.5%	56.1%	58.6%	46.7%	65.5%	57.2%
Part-Time	75	55	64	34	45	57	47	64	12	453
	18.3%	25.1%	28.4%	20.6%	26.0%	26.6%	27.8%	34.8%	20.7%	24.9%
FFGE	84	43	40	31	25	37	23	34	8	325
	20.5%	19.6%	17.8%	18.8%	14.5%	17.3%	13.6%	18.5%	13.8%	17.9%
Total	410	219	225	165	173	214	169	184	58	1817
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100.0%

---

[11] Ibid.

1. Naval Postgraduate School

The Naval Postgraduate School (NPS) is the cornerstone for advanced education in the Navy. The NPS also serves as the central point of review for officers desiring fully funded graduate education. Officers receiving a degree from the NPS do not bear any of the direct educational costs of their respective programs. However, officers are expected to pay for their own materials, and they receive a quarterly reimbursement of $125 to help defray the cost of textbooks. Degree programs at the NPS last anywhere from 12 months to 2 years and officers attend classes full time. The curriculum is primarily technical in nature, offering masters of science in 46 areas of study.[12] Of the 46 Master of Science programs, 31 are considered technical programs for the purposes of this study. Examples of technical fields are Applied Physics, Meteorology, or Aeronautical Engineering. However, the NPS also offers seven programs where an officer can earn a Master's of Arts, primarily in the area of National Security Affairs. Along with the Master of Arts curricula, examples of non-technical degrees are Masters of Science in Leadership and Human Resource Development, Management, and Defense Analysis. The NPS establishes its curricula based on the needs of various Navy and Department of Defense (DOD) sponsors. One advantage of the NPS is that it is able to respond to the needs of the naval service by tailoring its programs to match current educational demands.

---

[12] NPS School Catalog, Academic Year 2000.

2. Civilian Institutions

A number of fully-funded programs are available for officers to pursue full-time graduate education at Navy approved civilian institutions. Currently, 36 curricula are offered at over 65 civilian institutions in fields such as Operational Oceanography, Chemistry, Law, and Public Affairs.[13] The NPS serves as the central point of review for officers applying to these programs. Officers must meet the academic standards and standardized testing minimums of the respective universities. Once accepted into a civilian university degree program, officers retain their salaries and military status, but are considered full time students. The Navy covers the cost of tuition and educational fees, with the officer obligating for additional years of service after completing the degree. The degree programs offered at civilian institutions are meant to provide education in subspecialty areas not covered by the NPS or other DOD schools. Examples of these degree programs are degrees in Public Affairs, International Relations and Diplomacy, Education and Training Management, and Nuclear Engineering.[14] There are several other full time programs, limited to only one or two officers per year that provide advanced study opportunities at select universities throughout the United States and abroad.[15]

---

[13] Ibid.

[14] OPNAV NOTICE 1520, Funded Graduate Education Programs (FY-97), 21 October 1996. Enclosure (2).

[15] For more information on these programs, refer to OPNAVINST 1520.23B, Graduate Education, 1 October 1991.

3. Graduate Education Voucher (GEV) Program

The Navy provides funding for some advanced degrees earned during an officer's off-duty time. The Graduate Education Voucher (GEV) program, formerly known as Tuition Assurance (TASS), provides "up to $40,000 for two years of off-duty graduate education for unrestricted line officers whose career paths provide limited opportunity for full time graduate education."[16] Participation in the GEV program obligates an officer to remain on active duty 3 months for every month of schooling completed, to a maximum of 36 months. The obligation begins upon completion of, or disenrollment from, the degree program. In fiscal year 2001, 33 GEV program quotas are available for aviation officers. It is important to note that officers in this program are working in a full time Navy billet in addition to pursuing an advanced degree. The main requirement is that the degree program provide a 'Navy relevant' master's degree that fulfills the requirements of at least one subspecialty code.

4. Part-Time Graduate Education

The final way for naval officers to receive an advanced degree is to earn it on their own time. Officers incur all of the costs of the degree, and pursue the degree during their off-duty hours. In this instance, officers are free to chose their area of study and do not incur any additional service obligation. Officers that complete a degree in this manner are encouraged to notify the Bureau of Personnel of their advanced educational status. If the degree does not fulfill the requirements of the subspecialty system, a generic G-code

---

[16] NAVADMIN 015/00, Graduate Education Voucher Program, Formerly the Tuition Assurance Program. DTG 041955Z FEB 00.

for 'master's degree' is entered into the officer's service record. Many officers choose this form of obtaining a higher education because it allows for more options when making decisions about a naval career versus a transition to civilian life.

D.   SUMMARY

The Navy offers numerous opportunities for officers to obtain advanced education. The problem faced by the typical aviator is fitting graduate education into an already busy career. The first opportunity for full-time graduate education is during the first shore-tour rotation, at approximately the six-year mark in an average aviation career. The second opportunity is after the department head tour, approximately 11 years into a career. Many officers choose staff or FRS billets for shore-duty and attend graduate school at night. The most limiting circumstance is to pursue graduate education while assigned to an operational, or sea-going billet. Another factor working against earning a degree during sea-duty is the limited spare-time available to an officer. This makes it more difficult to complete a degree program, but not so much as to make graduate education impossible. The greatest difficulty lies in communication abilities while underway. However, with improvements in satellite transmission/reception capabilities, email, and the explosion of distance learning, Navy-sponsored graduate education may soon be available to officers while in a deployed status.

IV. DATABASE AND MODELING SPECIFICATION

A. DISCUSSION

The objective of this study is to assess the effects of a fully funded graduate education on promotion/command screen probability for fixed-wing, carrier-based aviators.[1] The logit model uses the joint probability of promoting to commander and screening for squadron command as its performance measure. Most, if not all, carrier-based squadrons are commanded by commanders (Pay Grade 5 officers). However, promoting to commander does not necessarily guarantee an officer will be selected to command a squadron and without a command tour it is unlikely that an officer will continue to ascend in rank in his or her operational specialty. The model uses various direct and proxy measures to account for ability, employment experience, and affective skills. This study is based on information from Department of the Navy administrative files, specifically officer data card (ODC) and performance summary report (PSR) information. The data set includes pre-commissioning education data as well as post-commissioning military experience data.

A pooled, cross-sectional time series database encompassing all aviation officers in the Navy that were considered for promotion to commander during fiscal years 1981 to 1989 was used as the basis of this study. These cohorts had the opportunity to be considered for promotion to captain in 1986 to 1995. The original data set consisted of

---

[1] "Naval aviator" refers to both pilots and naval flight officers throughout this study, unless otherwise stated.

3,585 observations, which account for all naval aviators, without regard to platform type. This study restricts the data to fixed-wing, carrier-based aviators, resulting in 1,817 total observations. After deleting observations with missing data, the final data set consists of 1,251 observations.[2]

The data were first restricted to naval aviators, to account for screening practices and differences in career paths between aviation and the other unrestricted line communities. Using additional qualification designations (AQD's), the data are restricted to fixed-wing, carrier-based aviators. This group includes officers qualified in the various fighter, attack, combat-support jets, and combat-support propeller-driven aircraft. This restriction serves several purposes. First, there is a general perception among carrier-based aviators that one's career is better served by accepting duty involving flying, even during an officer's scheduled shore-duty rotation. Serving as a flight instructor or working at one of the many weapons schools are examples of shore duties that maintain aviation currency. Any billet that effectively removes an officer from flying duties (such as staff tours, postgraduate school, or non-flying instructor duty) is perceived to have a much higher opportunity cost in terms of foregoing operational experience deemed valuable in the promotion process. Second, carrier aviation is a select community involving rigorous testing and competition. The limited carrier billets available and competition among flight students for carrier-based platforms effectively selects only the

---

[2] Missing data in the Percentage of Times Recommended for Accelerated Promotion as a Pay Grade 3 officer (PRAP3) variable accounts for 394 cases, and missing data in the Academic Proficiency Code variable accounts for 295 cases. Some observations are missing information in both variables, accounting for the final number of 1,251 observations. This is due to incomplete data or missing data from original Officer Data Card fields.

top performers among aviation junior officers into these billets. Third, training pipelines for carrier-based aviators can range anywhere from one to three years longer than rotary wing or land-based maritime patrol aircraft. This is due to the additional requirements surrounding aircrew certification for carrier operations. The longer time-to-train affects the windows of opportunity for shore-duty billets and heavily influences the decision officers make when deciding the type of shore-duty billet they would prefer. In short, this is a rather homogenous group, with a high level of motivation, with similar career paths and similar amounts of time spent in training squadrons, and with only a limited amount of time available to pursue fully funded graduate education.

B. VARIABLE DISCUSSION

Table 4.1 displays the variables hypothesized to have an effect on the probability of an aviator realizing the joint outcome of promote/command screen along with the expected signs of those variables.

Several interaction variables are included in the model to test the hypotheses discussed above. These interaction variables are used to better estimate the effects of type of degree earned in conjunction with the timing of that degree. As discussed earlier, there are limited opportunities in an aviator's career to obtain full-time graduate education. Equally as important in the decision to attend full-time graduate education is the type of degree desired. The interaction variables allow for a direct comparison of these effects when compared to officers without degrees, thus providing officers considering graduate education better information when making the graduate education decision.

53

Table 4.1 also provides descriptive statistics for the analysis variables. Further analysis of the variable categories is discussed later in this chapter. For this sample, about 40 percent have some type of graduate degree at the Pay Grade 5 point in a career, but less than 2.0 percent utilize that degree. Only six percent have undergraduate grade point averages greater than 3.2 on a 4.0 scale. The majority of the sample (72.9 percent) earned between a 2.20 and 3.19 grade point average in their respective undergraduate majors, showing that the sample is not necessarily skewed towards high undergraduate academic achievement.

The largest distribution of undergraduate majors is Humanities majors (25.7 percent), followed by Business majors (18.5 percent). Overall, the technical undergraduate majors of Bio-Physical Science, Math, and Engineering only account for 37.6 percent of the sample calling to question the emphasis on science and engineering backgrounds for naval aviators.

Commissioning source variables account for varying levels of human capital with Naval Academy graduates assumed to possess higher levels of firm-specific capital. The majority of the sample are graduates of Officer Candidate School (50.8 percent) followed by 27.3 percent attending the Naval Academy, 18 percent from ROTC programs, and 3.9 percent coming directly from enlisted ranks.

One interesting statistic is that over 90 percent of officers in the sample are married, with over 50 percent having at least two children. Plane types are evenly distributed with the exception of combat support propeller driven aircraft (only 8.6

percent of the sample), but traditionally these squadrons have been relatively small in size, consisting of only four aircraft per squadron.

Finally, 60 percent of the sample are pilots with the remaining 40 percent consisting of naval flight officers. Of these officers, 46.3 percent held the position of squadron maintenance officer and 44.9 percent held the position of squadron operations officer. The mean value for times recommended for accelerated promotion as a Pay Grade 3 officer is 45.3 percent, showing that being rated as a high performer is not just an automatic outcome in the Navy fitness report system.

Table 4.1 – Variable Descriptions, Distributions and Hypothesized Signs[a, b]

Variable Name	Description	% Distrib.	Expected Sign
Graduate Education[c]			
FFNTEARL	1=Completed full-time, non-technical program –6 to –2 yrs. before O4 board 0=All Others	.022	-
FFNTBEF	1=Completed full-time, non-technical program –1 to 0 yrs. Before O4 board 0=All Others	.013	+
FFNTAFT+	1=Completed full-time, non-technical program 1 to 4+ yrs. after O4 board 0=All Others	.027	+
TECHEARL	1=Completed full-time, technical program –6 to –2 yrs. before O4 board 0=All Others	.034	0
TECHBEF	1=Completed full-time, technical program –1 to 0 yrs. before O4 board 0=All Others	.009	0
TECHAFT+	1=Completed full-time, technical program 1 to 4+ yrs. after O4 board 0=All Others	.014	0
PARTGRAD	1=Earned a master's degree on officer's own time; 0=All Others	.281	+
NONE	1=No graduate degree. 0=Graduate degree	.600	Ref. Cat.
EVERUSE	1=Utilized P-Code Prior to O-5 Board; 0=All Others	.016	0
Undergraduate			
APC1	0=College GPA of 3.60-4.00 1=College GPA of 3.20-3.59 2=College GPA of 2.60-3.19 3=College GPA of 2.20-2.59 4=College GPA of 1.90-2.19 5=College GPA of 0-1.89	.011 .047 .321 .408 .199 .014	- (positive effect)
BIOPHYS	1=Bio-Physical Sciences Undergraduate Major; 0=All Others	.141	0
MATH	1=Math/Computer Sciences Undergraduate Major; 0=All Others	.070	0
SOCSCI	1=Social Sciences Undergraduate Major; 0=All Others	.181	0
HUMNEC	1=Humanities/Non-Engineering Undergraduate Major; 0=All Others	.257	+
BUSINESS	1=Business/Economics Undergraduate Majors; 0=All Others	.185	+
ENGINEER	1=Engineering Undergraduate Majors; 0=All Others	.165	Ref. Cat.
Commissioning Source			
ROTC	1=Commissioning Source is NROTC; 0=All Others	.180	-
OCS	1=Commissioning Source is OCS; 0=All Others	.508	-
ENL_RES	1=Commissioning Source is Enlisted Commissioning Program or Other Source 0=All Others	.039	-
USNA	1=Commissioning Source is USNA; 0=All Others	.273	Ref. Cat.
Marital Status			
MAR_2PLS	1=Married with Two or More Children; 0=All Others	.534	0
MAR_1C	1=Married with Zero to One Children; 0=All Others	.329	0
SING_DIV	1=Single or Divorced; 0=Married	.092	Ref. Cat.
Plane Type			
ATTACK	1=Plane type is A-4, A-6, A-7; 0=All Others	.371	0
CSJET	1=Plane type is EA-3, EA-6; 0=All Others	.225	0
CSPROP	1=Plane type is E-2; 0=All Others	.086	0
FIGHTER	1=Plane type is F-4, F-14, F/A-18; 0=All Others	.319	Ref. Cat.
Job/Occupation			
PILOT	1=Pilot; 0=Naval Flight Officer	.60	0
MAINTOFF	1=Served as a Squadron Maintenance Officer; 0=All Others	.463	+
OPSOFF	1=Served as a Squadron Operations Officer; 0=All Others	.449	+
PRAP3	Percentage of Times Recommended for Accelerated Promotion on 'Observed' Fitness Reports as an O-3	Mean .453	+

[a] Source: Officer Promotion History Files 1986-1990 & 1991-1994, Bureau of Naval Personnel.

[b] n=1,251.

[c] 11.9% have FFGE, 28.1% have Part-Time graduate education, and 60.0% have no graduate education.

C. HYPOTHESES

Within the Navy, proven performance in key billets is the cornerstone of the promotion system. The Navy uses an internal labor market, has various up-or-out stages within a given officer's career, and is hierarchical in its structure. This study's model follows Becker (1962,1975) and Wise's (1975) human capital models, which partition human capital into cognitive and affective skills.[3] Cognitive skills are those associated with reasoning ability, academic and analytical skills that an individual may acquire in school. Affective skills are those skills that help an individual function effectively within a given organization. Examples of affective skills would be the ability to motivate others, to deal effectively with conflict, and to lead a group of people to higher levels of performance. Affective skills are difficult to quantify, as certain traits may prove effective in one organizational culture, yet be unwelcome in another.

The prior literature indicates that as an individual accumulates more human capital, wages (Becker, 1975) or rate of promotion (Wise, 1975) tend to increase. For the Navy, pay is administratively set according to officer grade and therefore cannot be used to measure true productivity. A more accurate measure of officer performance is promotion to higher Pay Grades and ultimately screening for squadron command.

---

[3] Becker (1962, 1975) used salary and age-earnings profiles, where Wise (1975) suggested that promotions were a more valid measure of human productivity. Both methods seek to quantify productivity, as measured through a combination of ability and skill. See discussion in Chapter II, Literature Review.

1. Graduate Education

The logit model uses several proxies for cognitive and affective skills (see discussion in Chapter II) in order to characterize levels of human capital for a given set of officers and to evaluate their effects on the probability of promoting to commander (Pay Grade 5) and screening for squadron command. The literature review suggests that graduate education should have a positive effect on individual performance outcomes (Becker, 1975; Wise, 1975). For the model specified in this study, four dimensions of graduate education are examined: (1) undertaking a full-time versus part-time program; (2) technical specificity of the program; (3) timing of graduate education during one's career; and (4) utilization of graduate education in a later sub-specialty billet.

Officers selecting part-time graduate education fit a degree program in on their own time and do not realize the associated opportunity costs of non-observed fitness reports or time away from operational flying. Therefore, the first hypothesis of this thesis is that the acquisition of part-time graduate education should have a positive effect on promote/screen because the human capital augmentation will exceed the opportunity cost of the time spent completing the degree. As such, the sign for the part-time graduate education variable should be positive. Hypothesis testing for fully-funded graduate education is more complicated and this thesis seeks to test the effects of timing combined with technical specificity of a degree using several interaction variables. These hypotheses are discussed below, followed by a more in depth discussion of model variables and of the hypothesized signs and significance of secondary control variables.

There is an opportunity cost in obtaining fully-funded graduate education (FFGE). The officer realizes this cost in the form of at least two years of unobserved (non-competitive) fitness reports. Additionally, there is a cost in foregone billets at various points in a career. For example, an officer selecting FFGE two to six years prior to the Pay Grade 4 board is competing against officers who may be instructors at the FRS, TRACOM, or weapons schools (see Career Progression Chart, Ch. III). Officers not selecting FFGE are earning competitive fitness reports and continuing to maintain their flight proficiency, as well as enhancing their reputation within the aviation community. Therefore, the second hypothesis is that officers obtaining graduate education early (defined as two to six years prior to the Pay Grade 4 board) in a career would realize a net negative effect of FFGE as the opportunity costs are projected to exceed the positive human capital investment effect from enhanced productivity.

However, officers selecting FFGE no earlier than two years prior to the Pay Grade 4 board would have had time to establish a solid performance record in at least two competitive tours (the first operational fleet assignment and a follow-on tour as a flight instructor, for example) making the net effect of FFGE received just before the Pay Grade 4 board positive. The same holds true for those who select FFGE just after the Pay Grade 4 board. Officers usually screen for O-4 at the ten-year point in a career and have four years to complete a 2 1/2 year department head tour before becoming eligible for review at the Pay Grade 5 board. During this time, officers are junior in Pay Grade 4 and have an ample amount of time to fill positions outside of aviation with lower opportunity costs in fitness reports foregone, since they have had ten years of service to establish a

59

competitive record of achievement. In summary, the timing hypotheses are that selecting FFGE early in one's career will have a net negative effect and selecting FFGE no earlier than two years before the Pay Grade 4 board (defined as BEF and AFT+ in Table 4.1) will have a net positive effect on the promote/screen outcome.

A third hypothesis tested in this thesis evaluates the effect of technical specificity of a fully-funded degree. Aviation is a technical occupation, and in the early stages of an officer's career the emphasis is on mastering the complex systems of combat aircraft. It is not until the first sea tour that aviators begin to exercise superior-subordinate leadership skills. Even though the role of division officer requires the affective skills of a leader, a large portion of a junior officer's time in the first fleet tour is spent mastering the complex tactics and war-fighting skills required for carrier operations. It is not until later in one's career, namely the department head tour, that affective skills begin to assume an important role in the aviator's career development. The measurement point in this analysis takes place at the Pay Grade 5/Command Screen boards, a point at which officers are expected to exercise affective skills in the performance of their duties. For this reason, it is hypothesized that acquiring a graduate degree in a non-technical major (earned just prior to or just after the Pay Grade 4 board) would increase the officer's affective skills, which would benefit the officer during the department head tour and have a net positive effect on the promote/screen outcome. Technical skills are still required and will continue to play a large part in an officer's career; however, the gain in technical expertise is not as relevant as the organizational/affective skills required at higher pay grades. The hypothesis is that officers with technical degrees (holding timing constant)

will have a positive effect on the promotion/screen outcome, but the effect is less than for non-technical degrees.

The final hypothesis tested in this study is that utilizing a learned skill from a graduate degree program in an assigned sub-specialty billet should raise the level of job performance, and thus have a positive effect on the promotion/screen outcome. This would be offset, however, by the associated opportunity costs of serving in a non-operational billet. The variable EVERUSE indicates if a P-Coded officer served in a utilization tour prior to the Pay Grade 5 promotion board. Given the two opposing forces described herein, it difficult to assess the sign or significance of EVERUSE. Serving a "pay-back" tour should be beneficial to one's career progression, but the associated opportunity costs of serving in a non-operational billet may offset the initial positive effect. As such the hypothesized sign on the variable EVERUSE should not differ significantly from zero.

2. Other Causal Factors and Hypotheses

The following variables discussed in the chapter are specified in the promotion/screen model for the purpose of controlling for other factors that are expected to be related to the dependent variable. These include variables typically specified in human capital models, such as undergraduate education, type of college major, marital status, and accession source. In addition, other variables are included as proxies for what is typically termed one's motivation, desire, and perseverance. The explicitly specified variables in this model include self-selection into the various plane types, early career performance, and selection to key positions after close observation of personal

61

performance traits. Finally, fiscal year dummies are specified to account for promotion

and command screen directives that may differ over this nine-year period (1986-1995).

a. Undergraduate Education

College grade point average (APC1) and undergraduate majors

(BIOPHYS, MATH, SOCSCI, HUMNEC, BUSINESS, and ENGINEER) are included as

measures of cognitive ability and pre-commissioning academic performance. APC1 is a

nominal variable, coded from '0' to '5' with '0' representing a cumulative grade point

average between 3.6 and 4.0 on a 4-point scale. Note that APC1 is an inverted scale in

that as grades improve, the integer is decreasing. In accordance with theory (Becker,

1961) higher undergraduate grades should have a positive effect on promote/screen, and

thus one would expect a "negative" sign on this inverted variable.

The point in an officer's career that the performance outcome of

command/screen occurs affects the signs of the undergraduate major variables. The early

stages of an aviation career require a baseline of technical competence; however, as the

career progresses to the department head stage affective skills take on increasing levels of

importance. Certain majors provide an emphasis in management/leadership techniques,

and insights into human behavior that would benefit officers as a department head and

beyond. Specifically, business majors may provide an appropriate mix of

technical/mathematical education (which is beneficial early in a career) and the

management skills necessary later in a career. Social Science and Humanities majors

may have insights into human behavior that may be extremely helpful in leadership

positions and make them better suited to advanced management positions in a firm.

Engineering, Math/Computer Science, and the Biological-Physical Sciences focus on the mechanical application of processes, providing little, if any, education on management/leadership. As such it is hypothesized that BUSINESS, SOCSCI, HUMNEC coefficients will be positive when compared to ENGINEERS (the reference category). Coefficients for MATH and BIOPHYS will not differ significantly from zero.

b. Commissioning Source and Marital Status

The model also includes various demographic variables to control for differences in individual backgrounds between officers. Commissioning source variables control for differing levels of firm-specific training prior to commission (Bowman, 1990). Naval Academy graduates are expected to have higher initial levels of firm-specific capital due to intensive indoctrination and professional training as compared to other commissioning sources. Each commissioning source varies in length and intensity of training. The ROTC program lasts anywhere from 2 to 4 years, with professional courses taken in addition to normal college classes, however, it lacks the intensive training of the Naval Academy. OCS is an intensive 16-week indoctrination program, but the relatively rapid presentation of professional courses does not allow for much more than a fundamental knowledge of officership. Officers who were prior enlisted (ENL_RES) could be a graduate of any of the three previously discussed programs. While having prior fleet experience may offer some advantage in the form of perspective, and actual work experience, it is possible that the type of officer who decided to enlist out of high school rather than immediately continue their education may have lower levels of innate ability as evidenced by a rational decision to delay the college experience. For these

63

reasons, it is difficult to hypothesize the sign of this variable, however officership is intrinsically different from being an enlisted person and therefore coefficient for ENL_RES is expected to be slightly negative. In summary, the coefficients for ROTC, OCS, and ENL_RES are expected to be negative (compared to USNA).

The variables MAR0_1C, MAR_2C, and SING_DIV control for family background. Theory states that being married should have a positive effect on productivity outcomes (Becker, 1961); however, the stressors of military life on a family and the competition between the workplace and the home are expected to nullify the positive effect and to not differ significantly from zero.

The final sets of variables included in the model are added to control directly for a potential selection-bias that may characterize graduate school enrollment. Officers who enroll in graduate school are not assigned on a random basis (see Chapter III). Rather they first have to possess the motivation and drive to complete a graduate degree program, and secondly their prior academic and military performance must be sufficiently strong to warrant selection by the Navy. This is especially true for fully-funded resident programs at NPS and selected civilian institutions. From a statistical perspective, this non-random selection process can introduce an upwards bias to the estimated impacts of graduate education because part of the reason why those with a graduate degree may be more likely to promote/screen is due to their inherent greater stock of human capital and/or their being endowed with greater innate ability. If one does not somehow "control" for this fact, then the estimated impact of graduate education will be biased upwards as it includes the direct effect of enhanced productivity from acquiring

64

a graduate degree plus the indirect effect of being associated with individuals who, prior to obtaining a graduate degree, were more likely to promote/screen in the first place.

A common approach not followed in this model is to specify a two-stage regression model to control for self-selection bias, as is done with the "Heckman Correction" methodology.[4] In this approach, a selection model is first estimated and the error-term from this model is next used as an additional explanatory variable in the main outcomes equation. This approach is often used when a researcher lacks information about individual motivation, desire, perseverance and behavior. However in this unique database, it is assumed that the researcher can rely explicitly on profiles for these factors and as such, one can specify a simple single-stage model of the individual promotion/screen outcome.

c. Plane Type

As discussed in Chapter II, and Chapter III issues of self-selection exist within not only between warfare communities, but also within the aviation warfare community. As a generality, better performers select into the fighter and attack communities. The four community categories, ATTACK, CSJET, CSPROP, and FIGHTER also control for differing degrees of selection and variation in command opportunity among the platforms. At the commander promotion/command screen boards, officers have made a rational decision to stay in the Navy and the Navy has allowed them to continue to at least the Pay Grade 4 point because of an above average level of

---

[4] See for example: James Heckman, Sample Selection Bias as a Specification Error. Econometrica, v.47, Issue 1, pp. 153-162, January, 1979.)

performance. As such, abilities and performance are less affected by plane type than by individual selections. This variable is a proxy not only for initial self-selection, but also accounts for differences in command opportunity that may exist among the various plane types. The fighter community is traditionally viewed as the most select group among carrier aviators, however, due to the point of measurement, it is hypothesized that none of the communities (ATTACK, CSJET, or CSPROP) will differ significantly from zero.

d. Job/Occupation

As explained earlier, the variable PILOT controls for any differences in human capital and possible differences in selection behavior between pilots and naval flight officers. While, pilots are hypothesized to be a more select group, naval flight officers are hypothesized to have more firm-specific capital, as their aviation skills do not directly translate to civil aviation (see Chapter III). Since these two factors work in opposite directions, the coefficient on PILOT is hypothesized not to differ significantly from zero.

To better assess the affective skills and account for the unobserved qualities in officers, variables for two key billets in a carrier-based squadron are used. The first is MAINTOFF, denoting an officer who filled the position of squadron maintenance officer. The second is OPSOFF, denoting an officer who served as a squadron operations officer.[5] It is important to understand the significance of these positions, and why they are hypothesized to be valid measures of both affective skills,

---

[5] Michael Orzell (1998) used these variables as indicators of 'good jobs.'

66

such as motivation, drive, and perseverance; and performance in Pay Grade 4. These two positions are normally held by a Pay Grade 4 officer who has been assigned to a particular squadron for at least 1½ to 2½ years. Unlike other URL communities, aviation officers are sent to a 'generic' department head tour.

The various positions they will hold in a squadron are determined by the squadron's commanding officer, not the community detailer. As such, only the top performers, based on direct observation in that particular squadron, are assigned to these positions. This assignment process accounts for the difficulties in assessing levels of human capital through quantifiable data (which is all the community detailers have available to them). These variables are included to attempt to capture the non-quantifiable effects of individual motivation, ability, initiative, decision-making, and imaginative thinking, since being selected for these positions reveals a commanding officer's true evaluation of these qualities. It is expected that these variables will be highly significant and positive.

Finally, performance as Pay Grade 3 officer (PRAP3) is included to control for observed differences in early career performance. Performance in a competitive billet is the basis for promotion in the Navy (Chapter III) and including PRAP3 in the model is a control for any potential selection bias that may arise due to these differences. The variable PRAP3 is hypothesized to have a large, positive effect on the promote/screen outcome.

All models incorporate fiscal year dummies to account for changes in the fiscal environment such as promotion rates and command opportunity, which may vary

67

annually. Significant downsizing occurred at numerous point throughout the nine year time frame of this analysis, and may introduce a negative effect on the promote/screen outcome in the affected years.

D.   METHODOLOGY

This study will use non-linear, maximum likelihood estimation techniques to evaluate the effects of the independent variables on the promotion/command screen outcome. Since the dependent variable in this case is dichotomous (1=promote/screen, 0=did not promote/screen), we will use a logit model to determine the probability of the outcome occurring, given some value for the independent variables. The estimation technique maximizes the likelihood that the $X|Y$ population is best represented by the observed sample of $X|Y$ pairs. The benefit of this estimation method is that tests for statistical significance (e.g., t-values) are statistically reliable. (Bowman, 1998).

E.   SUMMARY

The model specified to measure the effects of a fully-funded graduate education include variables to control for differences in human capital between individuals and self-selection processes as well. The purpose is to arrive at the most unbiased estimator for the effects of fully-funded graduate education on promotion/command screen. The model controls for observable characteristics, such as undergraduate grades, major, and other variables discussed earlier. An important aspect of this model is its indirect measurement of the unobservable characteristics, such as motivation, desire, and perseverance, through use of the Maintenance and Operation's officer and Pay Grade 3 performance (PRAP3)

variables. It should be noted that the graduate education coefficients are typically subject to self-selection bias and without the previously discussed controls in the model the impacts of graduate education coefficients would be biased upwards. Ultimately, the model seeks to quantify the increase in productivity as measured by promotion/command screen by controlling for the possibility that officers entering a fully-funded program may be inherently more productive prior to entering FFGE and the act of acquiring additional stores of human capital must be distinguished from the fact that more able and highly motivated individuals are selected for funded graduate education programs in the Navy.

THIS PAGE INTENTIONALLY LEFT BLANK

V.   EMPIRICAL FINDINGS

This chapter will discuss the empirical findings of this thesis. Previous discussion has described an aviator's career path as a finite and definable progression from initial flight training through eventual screening and selection for promotion to commander/screening for squadron command. This process occurs over an extended period of time, where the individual officer is faced with various up-or-out decision/screen points. It is precisely due to this increasingly competitive and constantly narrowing field of competitors that each duty assignment carries both a perceived cost and benefit for the individual officer and for the Navy. The cost of a graduate program includes the direct education costs of books and tuition, and more importantly the opportunity cost of an officer's time in the program. For off-duty programs this cost is merely the leisure time after work forgone. But for fully-funded programs it includes the time spent away from one's operational specialty. This is time otherwise spent in a competitive or observed billet while continuing to build one's professional reputation as an aviator, and is expected to change over one's career progression.

The perceived benefits of graduate education is based upon human capital theory, which asserts that education enhances both general and firm-specific skills and thereby increasing an officer's marginal productivity.

We assume both off-duty and full-time graduate programs increase an officer's general education skills, whereas only the fully-funded programs enhance Navy-specific skills that may be applied to "P-Coded" billets in follow-on utilization tours. The problem faced by officers choosing graduate education, however, is that perceived costs

71

may be higher than perceived benefits in terms of promotion/screen, and to further complicate the question, the opportunity costs may vary depending on when in a career an officer undertakes graduate education. To better estimate the unique impact of graduate education on the promote/screen outcome at the commander promotion point, one should control for individual characteristics associated with innate ability and motivation as well as the type and timing of the obtaining a graduate degree.

The findings of this thesis would be generally applicable to hierarchical organizations that seek to quantify whether cognitive skill development at a post-graduate level enhances future career development. The unique approach of this thesis is that we account for the fact that opportunity costs may vary significantly depending on when advanced education is undertaken.

The first section discusses the impacts of fully-funded graduate education and technical specificity of a full-time degree. The second section addresses graduate education models with the addition of timing of the degree in relation to the Pay Grade 4 board. Timing is included to account for variation in opportunity costs versus human capital accumulation at various stages of an aviator's career. Once timing of a degree is controlled for, we begin to see significant and positive impacts for various types of graduate degrees. The final logit model incorporates controls for individual characteristics, which separate the impact of the graduate degree from the type of officer who may acquire a degree, providing the best impacts of graduate education on the promote/screen outcome. The analysis concludes with notional person analysis to more clearly illustrate the logit regression estimates.

A. LOGIT MODELING: TYPE OF GRADUATE EDUCATION

The first modeling specification considers full-time graduate education grouped

by technical specificity of the degree. Technical specificity of a degree is considered

because different kinds of human capital may be acquired depending on the degree

program. Comparison of technical and non-technical programs is also done to

Figure 5.1

Observed Promote/Screen Rate by Graduate Degree Status for Pay Grade 4 Officers (n=1,251)
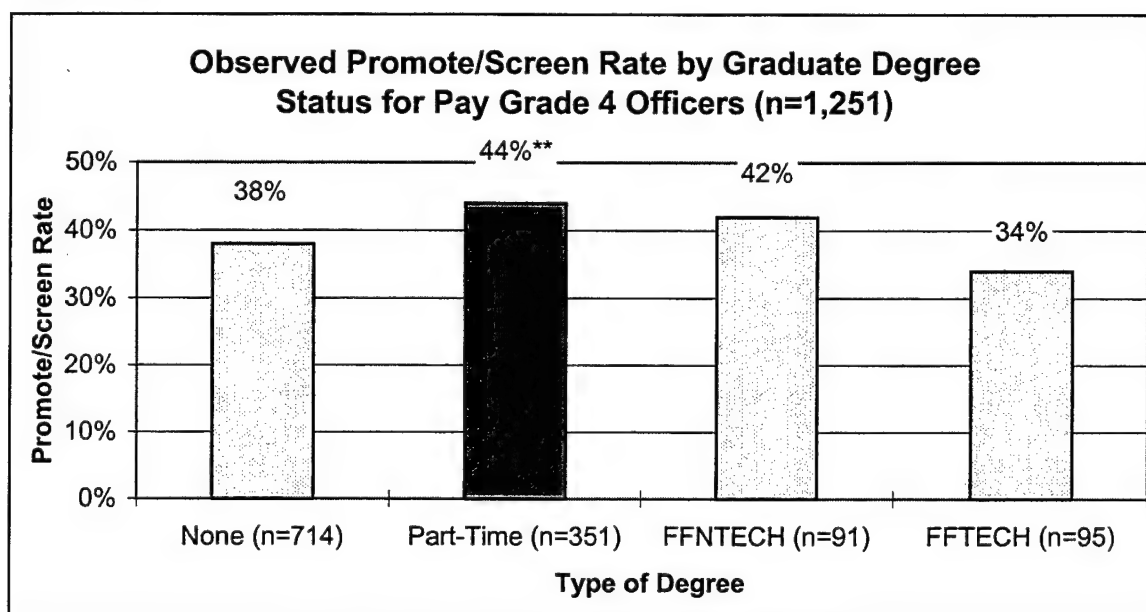
Note: Average Promote/Screen rate = 38.8%

emphasize the Navy's continuous demand for officers with technical backgrounds.

Figure 5.1 displays the mean values of promote/screen for Pay Grade 4 officers grouped

by the technical specificity of a full-time degree. The promote/screen rates for full-time

technical (FFTECH) and full-time non-technical (FFNTECH) promote/screen rates do

not differ significantly from the aggregate mean promote/screen rate, which is 38.8

percent.[6] Only the mean rate for part-time graduate education shows any significance

---

[6] Associated t-tests are included in Appendix D.

73

(p<0.05), with a promote/screen rate of 44%, which is 5.2 percentage points above the

mean rate of promote/screen.

A logit model (Table 5.1) considering the technical specificity of a full-time

degree is estimated to test the effects of technical specificity on the dependent variable,

Table 5.1 – Model #1, Dependent Variable = Promote/Screen[a, b] (n=1,251)

	Coefficient	(S.E.)
Constant	-.684	
Technical Full-Time:	.118	(.242)
Non-Technical Full-Time	-.211	(.242)
Part-Time[c]	**.282****	(.140)

[a]   Model incorporates fiscal year dummies with FY84 as the omitted category.
[b]   Statistical significance indicated as follows: *=0.10, **=0.05, ***=0.01.
[c]   No Graduate Degree is omitted category.

promote/screen. This initial specification shows the impacts of graduate education

independent of any human capital or self-selection controls. This first modeling

specification is an estimate of the impacts of graduate status on promote/screen outcomes

and does not attempt to separate the impact of acquiring a degree from the types of

officers who choose to complete and who are selected to attend a graduate degree

program.

Table 5.1 illustrates that the full-time graduate education coefficients for both

technical and non-technical degrees are insignificant, showing that no premium is

realized by aviators undertaking full-time graduate education. However, it is also

important to note that these officers are not at a disadvantage when compared to officers

74

without degrees, as they enjoy approximately the same probability of promote/screen as officers without degrees (the omitted category).

In this model, full-time technical and non-technical degrees carry the benefit of both firm-specific and general human capital accumulation, where part-time graduate education is purely general human capital, since a sub-specialty code and possible future utilization are tied to the first two categories. However, the critical difference between full-time and part-time education is the net costs of each program. It is possible that the net costs for fully-funded programs in terms of billets foregone is so high, that it offsets the additional benefits that should be realized through an associated increase in both firm-specific and general human capital. Conversely, the opportunity cost of part-time graduate education is relatively low, setting a lower threshold in terms of personal and professional benefit. This could explain the resilience of part-time graduate education throughout the various model specifications.

Table 5.1 shows that it makes little difference whether an officer chooses a technical or non-technical degree program for full-time graduate education. However, officers who complete graduate education on their own time realize a positive premium on the promote/screen outcome. This preliminary model suggests that full-time graduate education does not enhance or reduce one's chances for promotion to commander/screen for squadron command. But prior discussion and literature suggest that other factors must be considered in context with graduate education. Throughout an officer's career, the effects of motivation, ability, management of personal affairs, occupation and performance are either directly considered or have an indirect effect on performance and

ultimate selection for promotion/command screen. The next section considers the effects of timing of a degree, in addition to technical specificity. As will be shown, once we consider the timing of a degree, the individual officer begins to realize positive effects for various types of full-time graduate education.

B.   LOGIT MODELING: TYPE AND TIMING OF GRADUATE EDUCATION

Observed Outcomes. The purpose of this study is to evaluate the effects of graduate education on the probability of promoting to Pay Grade 5/screening for squadron command. This section takes the previous analysis one step further and incorporates interaction variables to account for the acquisition, timing, and technical specificity of fully funded graduate education. As discussed previously, opportunity costs for aviators are not fixed. The opportunity costs vary depending on when graduate education is undertaken. Included variables accounting for timing of a degree are critical, as model estimates will show we start to see significant, positive impacts of fully-funded, full-time graduate education. The section begins with a discussion on the observed differences between graduate education variables and describes the logit model used in the analysis.

Figure 5.2 displays promote screen rate by type of graduate degree. The mean rate of promotion/screen for officers without graduate education (NONE) is 38.1 percent.

Figure 5.2

Unadjusted Promote/Screen Rate by Graduate Degree Status for Pay Grade 4 Officers (n=1,212)[a]

Bar chart showing Mean Rate of Promote/Screen* (y-axis, 0% to 80%) by Type of Graduate Degree (x-axis):

- None (n=714): 38.1%
- FFTECH EARLY (n=42): 47.6%
- FFTECH BEFORE (n=11): 54.5%
- FFTECH AFTER+ (n=17): 70.6%
- FFNT EARLY (n=27): 29.6%
- FFNT BEFORE (n=16): 62.5%
- FFNT AFTER+ (n=34): 41.2%
- PART TIME (n=351): 44.4%
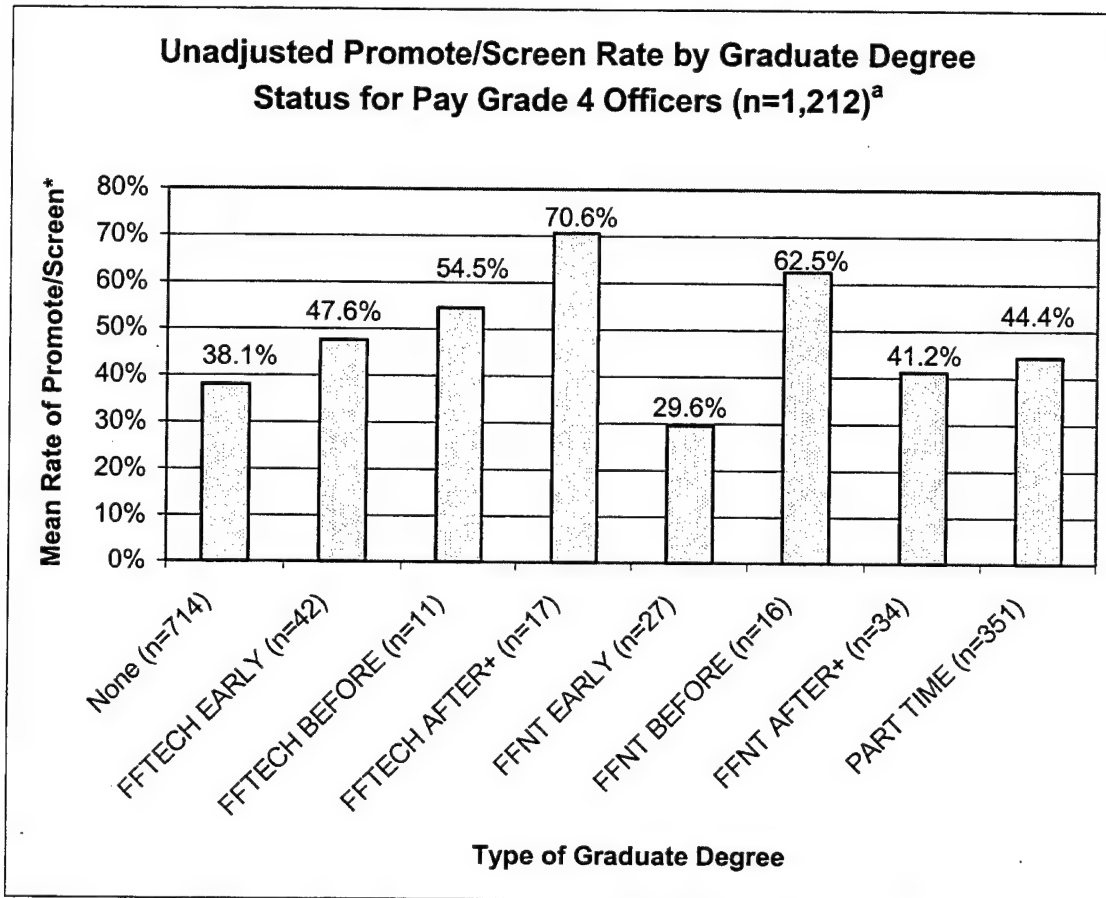
Note* Aggregate Mean Rate of Promote/Screen is 38.8%.
[a] Once timing of education is included in the model, 39 of 95 officers getting full-time technical degrees are omitted. This is from missing data on year when degree was awarded in this particular category.

At first glance, it appears that most graduate education, regardless of timing, type, or technical specificity has a positive effect on promote/screen compared to officers without graduate education (NONE). The one exception is for those officers who earn a master's degree in a non-technical field six to two years before the Pay Grade 4 board (FFNT EARLY), who promote/screen at a rate of only 29.6 percent. However, in this table the effects of other factors, such as affective skill, performance, and differing backgrounds that may influence the promote/screen outcome, have not been accounted for.

Given the observed outcomes, a logit model is specified to test the impacts of timing of a degree on the promote/screen outcome, independent of controls for differences in cognitive skills, innate ability, and selection involved in the graduate education analysis. Table 5.2 shows the impacts of each graduate education category with respect to timing of a degree. Part-time education remains independent of the timing question, yet still must be considered in order to control for people with similar trends in human capital accumulation.[7]

Table 5.2 – Model #2, Dependent Variable = Promote/Screen[a, b, c] (n=1,251)

	Coefficient	(S.E.)
Constant	-.746	
Graduate Education		
Part-Time	**0.351****	(.139)
Non-Technical Full-Time:		
Early	-0.072	(0.481)
Before O4 Board	**1.416****	(0.606)
After O4 Board	0.377	(0.420)
Technical Full-Time:		
Early	**0.754***	(0.406)
Before O4 Board	0.639	(0.719)
After O4 Board	**1.621*****	(0.587)
Utilize Degree	**-0.605***	(0.343)

[a.] Model incorporates fiscal year dummies with FY84 as the omitted category.
[b.] Statistical significance indicated as follows: *=0.10, **=0.05, ***=0.01.
[c.] No Graduate Degree is omitted category.

Table 5.2 shows that once the varying opportunity costs are controlled, in terms of when graduate education is acquired, the impacts of graduate education often become

---

[7] Since no time in one's community is foregone when undertaking part-time programs, it is not necessary to control for the year in which a degree is earned off-duty.

positive and significant. Full-time technical graduate education, earned just after the Pay Grade 4 board, shows the largest significant and positive impact for graduate education. A technical degree earned 2 to 6 years prior to the Pay Grade 4 board is positive and significant as well, but the impact is half that of a technical degree earned later in a career. The only non-technical degree with any significant impact is one earned just prior to the Pay Grade 4 board. However, "non-technical before" degree holders have approximately the same probability of promote/screen as officers earning technical degrees later in a career. Part-time graduate education maintains a positive and significant impact on promote/screen even with controls for timing of full-time education included in the model. It is interesting to note that the impacts of the three significant full-time degrees are 2 to 4 ½ times that of part-time graduate education, showing a larger net benefit for several full-time programs when one controls for varying opportunity costs. Once again, it is possible that the benefit from part-time graduate education is relatively small in terms of accumulation of firm-specific human capital, but the associated opportunity costs of competitive billets foregone is small or even non-existent. It does appear that utilization of a degree has a negative impact on the promote/screen process. But much like the above discussed graduate education coefficients, it is difficult to draw conclusions without controlling for differences between individual officers in the sample.

Timing of a degree is crucial because opportunity cost varies by time in an officer's career; however, we must also recognize that net benefits to acquiring a graduate degree may across types of officer, who screen/select into the various graduate education

programs. Once we control for differences across individuals, with varying levels of cognitive and innate abilities, we expect to derive better estimated impacts of graduate education programs on officer promotion/screen outcomes.

C.   FINAL LOGIT MODEL RESULTS

Previous discussion and model specifications show that timing and technical specificity of a graduate degree have a significant impact on the promote/screen outcome. However, neither Model One nor Model Two attempted to control for individual characteristics that may have an effect on both the decision to earn an advanced degree and on the promote/screen outcome. Such characteristics include differences in innate ability, motivation, and in selection practices between various aviation communities. The primary purpose of this thesis is to evaluate the impact of full-time graduate education on promoting to commander/screening for squadron command. Controlling for factors involved in the graduate education decision/selection allows us to derive a more accurate and less biased impacts of full-time graduate education, on career progression.

The final elements in the fully specified model for graduate education below are controls for self-selection. By controlling for differences in both cognitive and affective skills, this model specification adjusts for self-selection bias and yields the best estimates of the true impacts of the various graduate education programs examined in this study.

There are two separate dimensions to the discussion in this section. The first explains the impacts of graduate education versus other factors related to the promote/screen outcome. Additionally, it offers an explanation of the impacts of these

other factors, which include both observed characteristics and proxies for unobserved motivation and dedication which are factored into the model to control for self-selection bias. Part two below discusses graduate education with distinctions made between fully-funded technical, fully-funded non-technical, and part-time graduate education and the importance that timing plays in the final modeling specification. Additionally, controls for self-selection bias will be discussed throughout.

Based on economic theory and evaluation of the data, the final logit model is specified to better estimate the impacts of various restrictions placed on the model. Table 5.3 summarizes the results of the final statistical model and includes Model Two (from Table 5.2) for comparison. Covariates with a high degree of statistical significance are designated with asterisks. (All models incorporate fiscal year dummies, with FY84 as the omitted category, to account for differences in board directives, fiscal environments, and the like.) The final model (Model Three) builds on the previous one to better estimate the true effects of graduate education on the probability of promote/screen.

Table 5.3 – Dependent Variable = Promote/Screen[a, b, c]

	Model #2 (n=1,251) Coefficients (S.E.)		Model #3 (n=1,251) Coefficients (S.E.)	
Constant	-.746		-2.334	
Graduate Education				
Part-Time	**0.351****	(.139)	**0.265***	(0.156)
Non-Technical Full-Time:				
Early	-0.072	(0.481)	-0.724	(0.486)
Before O4 Board	**1.416****	(0.606)	0.949	(0.624)
After O4 Board	0.377	(0.420)	-0.228	(0.409)
Technical Full-Time:				
Early	**0.754***	(0.406)	0.291	(0.381)
Before O4 Board	0.639	(0.719)	0.286	(0.683)
After O4 Board	**1.621*****	(0.587)	**1.133***	(0.58)
Utilize Degree	**-0.605***	(0.343)	0.343	(0.567)
Other Controls				
Undergraduate Grades	--		**0.174****	(0.082)
Undergraduate Majors				
Bio-Physical Science[d]			-0.249	(0.253)
Math	--		0.200	(0.314)
Social Sciences	--		0.044	(0.241)
Humanities	--		**-0.430***	(0.233)
Business	--		0.304	(0.235)
Commissioning Source				
ROTC[e]	--		-0.213	(0.213)
OCS	--		-0.16	(0.172)
Prior Enlisted	--		**-0.804***	(0.425)
Marital Status				
Married with 0 to 1 children	--		**0.786*****	(0.229)
Married with 2 or more children	--		**1.070*****	(0.220)
Community				
Attack[g]	--		**0.412****	(0.167)
Combat Support Jet	--		0.282	(0.189)
Combat Support Props	--		-0.372	(0.290)
Occupation/Jobs				
Pilot	--		-0.076	(0.142)
Maintenance Officer	--		**0.693*****	(0.138)
Operations Officer	--		**0.626*****	(0.137)
Early Career Performance				
Percent Times Recommended for early promotion	--		**1.658*****	(0.184)
-2 Log Likelihood	1517.651		1304.256	

a. All models incorporate fiscal year dummies with FY84 as the omitted category.
b. Statistical significance indicated as follows: *=0.10, **=0.05, ***=0.01.
c. Engineering major is the omitted category.
d. USNA is the omitted category.
e. Single/Divorced is the omitted category.
f. Fighter community is the omitted category.

Model Two in Table 5.3 (which duplicates Table 5.2 above) evaluates the impact of graduate education variables on the promote/screen outcome without controlling for individual differences in officers including possible self-selection bias and was discussed in detail in the previous section. Model Three incorporates human capital variables such as undergraduate grades and major, commissioning source, and marital status. Additionally, the final model (Model Three) controls for factors related to individual motivation, drive, and desire to address issues of self-selection bias. This third and final model takes into account pre- and post-commissioning factors hypothesized to have an effect on an officer's career path. The extent of adjustments included in Model Three is comparatively large. Previous literature has considered the technical specificity of a degree, human capital variables, and controls for ability and motivation (Bowman & Mehay, 1999; Orzell, 1998; Buterbaugh, 1995). However, this thesis takes the prior literature a step further and incorporates the timing of a degree, as well as community specific controls to account for different levels of motivation, training, and command opportunity among the various aircraft types.

It is important to realize that Model Two in Table 5.2/Table 5.3 is subject to an upwards bias on the estimated impacts of graduate education due to the self-selection process explained above and in Chapter IV. Model Three explicitly controls for self-selection bias, as well as human capital factors, presenting the best estimators of the impacts of graduate education on promote/screen.

1. Discussion of Control Variables

In the final model specification (Model Three, Table 5.3), various control variables are included to account for differences in individual behaviors and factors that may influence a given career. This section discusses five factors other than graduate education that have an effect on the joint outcome of promoting to commander/screening for squadron command: 1) undergraduate performance, 2) commissioning source, 3) marital status, 4) plane type, and 5) jobs/early career performance. A discussion of graduate education estimates follows in the next section.

a. Undergraduate Academic Performance Covariates

As seen in Table 5.3, undergraduate grades are significant and have a positive effect on the promote/screen outcome. To the extent college grades act as a proxy for innate abilities, those officers with better grades are more likely to promote/screen. A humanities major is the only significant undergraduate major in the final model, having a negative effect on the promotion/screen outcome. It is hypothesized that being a humanities major would have a positive impact on promote/screen, due to insights into human behavior gained through a liberal education. It was expected that officers at the department head level (the point of measurement for this study) would realize a gain from any non-technical education, due to the increased requirements for management/leadership skills at higher levels of the organization. The negative impact of the humanities major covariate is possibly indicative of the high level of technical expertise expected in an officer's career. Bivariate correlations (shown in Appendix A) show humanities majors to have higher early career performance scores

than engineers (the comparison category). It is possible that these officers may possess greater initial affective skills but lower cognitive and technical skills early in a career. A large portion of an aviation junior officer's job is mastering the complex systems and procedures involved in operating modern aircraft. Those officers without any technical training are at an initial disadvantage, especially in flight school and the FRS. The management or "people" skills these officers may possess do not become evident until later in their first or even second sea tours, when they are assigned as division officers or department heads. It is precisely at this point that the humanities, social science, and other non-technical majors should realize a premium over those officers with hard math, science, and engineering backgrounds. It should be noted that even though there is an increase in the relevance of affective skills, technical skills are still highly relevant as long as an officer is involved in the operation of combat aircraft. Surprisingly, being a business major, though positive, does not differ significantly from zero in the final specification. The hypothesis was that business majors would show a positive and significant impact, as this degree usually emphasizes management education in addition to mathematical/technical courses.

b. Commissioning Source

Naval Academy graduates (the comparison category) do not hold any statistically significant advantage over ROTC and OCS graduates. The initial hypothesis was that Naval Academy graduates would enjoy a premium over all other commission sources due to higher levels of firm specific capital. However, officers who are prior-enlisted are less likely to promote/screen when compared to Naval Academy graduates.

This negative effect could be due to these officers having lower levels of human capital. As displayed in Appendix B, the estimates for prior-enlisted officers fall by 29.8% when the early career performance is added to the final model, suggesting that part of this effect is due to lower early career performance scores of prior enlisted officers.

c. Marital Status

Recent discussion concerning quality of life issues has highlighted the role that family plays in a service member's career. On the surface it seems that the pace of military operations and the ambiguities or uncertainty that are a normal part of a military career would be incompatible with having a family. Human capital theory states that being married should have a positive effect on job performance; however, the strain that a military career places on a marriage suggested that military service would nullify this effect. However, both categories of married officers with either a spouse or children are significant and positive when compared to officers who are single or divorced. It is possible that officers with families have some degree of stability or support at home that helps them adjust and/or perform better in the military environment (Becker, 1975). Officers who are single/divorced may be more likely to leave active duty due to perceived higher opportunities in the civilian sector. Conversely, it is possible that extra compensation for having dependents is a small retention factor for naval officers when one considers that pay or compensation in a civilian firm does not usually consider whether an employee is married or has dependent children.

d. Plane Type

Variables for the various plane types are included in the final model for several reasons. First, they account for potential issues of self-selection bias at the beginning of a career. They also account for potential differences in command opportunity among the various plane types. For example, a typical carrier air wing has two fighter (F-14) squadrons, two fighter/attack (F/A-18) squadrons, and one each of electronic attack (EA-6B), anti-submarine warfare (S-3), and early warning squadrons (E-2C). This means that the command opportunity is almost double for the fighter and fighter/attack communities, holding all other factors constant. For the time period of this study, the medium attack community (A-6E) was still in service, and accounted for two squadrons per air wing until around 1989, when air wings deployed with a single, but larger A-6E squadron. The coefficient for the A-6E community (ATTACK) is significant and positive when compared to the fighter community (the omitted category). Preliminary statistical models[8] show that the Attack coefficient effectively doubles in size when PRAP3 is added to the model. In essence, attack aviators were less likely to be recommended for accelerated promotion than aviators in the fighter community. Nonetheless, there is still a positive effect of being a member of the attack community in the final specification. One possible explanation was a steady increase in command opportunity prior to the decision to retire the A-6E in 1993.

---

[8] See Appendix B.

87

e. Jobs and Early Career Performance

Performance in key billets is considered a prerequisite to promotion and command screen. Chapter IV describes the two key-billet variables in detail. As hypothesized in Chapter IV, both the maintenance officer and operations officer variables are significant and positive. The addition of early career performance to Model Three shows a slight increase in the positive effect that holding a good job has on promote/screen because without accounting for prior performance, the estimates of these covariates are biased downwards.[9] Including early career performance in the final specification gives better estimates for these coefficients because of the indirect positive effect of performance on promotion/screen through selection to key positions. This is evidence of the effect of commanding officers screening their top performing department heads into the two positions essential to running a squadron efficiently and effectively. These are the qualities considered when the promotion and command screen boards select the "best qualified officers" for advancement.

There is a general perception that the less prestigious occupation of naval flight officer places this group at a disadvantage for promotion/screen when compared to pilots. This is not supported by the data, as the coefficient does not differ significantly from zero.

The last control variable to discuss is early career performance. This variable measures the percentage of times recommended for accelerated promotion in Pay Grade 3. To be considered a valid recommendation, the fitness report has to be

---

[9] Ibid.

competitive, where an officer is rated during a regular reporting period or the detachment of the reporting senior. Fitness reports where an officer is ranked number 1 of 1, detaching fitness reports, and fitness reports received while in a training or schooling status are not considered valid. This covariate is highly significant and positive and has a noticeable effect on all other controls in the model as discussed above. The significant, positive effect of this variable reinforces the Navy's position that top performance in a competitive billet is the primary metric for officer advancement.

2. Discussion of Graduate Education Covariates

This section explains the impacts of graduate education by first discussing the impacts of graduate education, independent of controls for self-selection bias (Model One, Table 5.2). Secondly, graduate education effects are evaluated once we control for observable characteristics and issues of self-selection bias inherent in the promote/screen process (see Chapter III and Chapter IV.) This section will discuss graduate education with distinctions explained between fully funded non-technical, fully funded technical, utilization of a degree, and part-time graduate education and the importance that timing plays in the final modeling specification. Controls for self-selection bias will be discussed throughout.

a. Fully-Funded Graduate Education

Model Two in Table 5.3 evaluates the effects of graduate education on promotion/command screen free of any controls for other aspects of an officer's career. The covariates are interaction variables that account for both the timing and technical

89

specificity of a fully-funded graduate degree. As discussed above and in Chapter III, timing is a large factor in an officer's career. The decision to attend full time graduate education depends on an officer's future promotability and what the window of opportunity may be to attend a full time program. Remember that timing is a measure of the opportunity cost of acquiring a degree. This cost varies throughout a career. Where officers earn a degree *early* in a career, the opportunity cost may be higher, since the majority of their peers are primarily in competitive flight billets. The cost would be negligible *before* the Pay Grade 4 board, as this is the normal time to rotate to a shore-duty billet. At this point the technical specificity may be the deciding factor for realizing a gain or a loss from graduate education and it was hypothesized that officers earning non-technical degrees would be able to more directly apply the affective skills learned in a non-technical curriculum as future department heads. Earning the degree after the Pay Grade 4 board may have very little opportunity cost for both technical and non-technical degree holders, as career options at this point are extremely diverse, and time out of the cockpit is not as large an issue, due to the total time accumulated in operational flight billets.

Non-Technical Graduate Degrees. Model Two in Table 5.3 shows four out of seven graduate education covariates to be significant and positive in the promotion/command screen equation. Earning a non-technical degree, at least one year before the Pay Grade 4 board is significant and positive, however the impact becomes insignificant once all controls are included in Model Three. Bivariate correlations show that officers earning a non-technical degree before the Pay Grade 4 board are more likely

90

to have higher early career performance ratings than officers without graduate degrees (the comparison category). In essence, even though the effect of the coefficient is reduced, it is a less biased estimator, and better captures the positive (though statistically insignificant) effect of earning non-technical degree before the Pay Grade 4 board on promote/screen. Non-technical degrees earned either *early* or *after* the Pay Grade 4 board are never significant. There appears to be some measured benefit from earning a fully funded non-technical degree one year or less prior to the Pay Grade 4 board; however, it appears that officers who are superior performers early in their careers are selecting into the non-technical programs. Since many of these degrees are in management or policy-related majors, it is possible that the skills learned in these programs are perceived to translate well towards the managerial role an officer will fill as a squadron department head, shortly after this time period. (See Career Progression Chart, Chapter III).

Technical Graduate Degrees. For the full-time technical degree holders, the coefficients for *early* and *after* the Pay Grade 4 board are positive and significant before any additional controls are introduced. When the various controls are added to the model the coefficient for full-time early becomes insignificant and drops in size. Only *full-time after* maintains its significant and positive effect. To select/be selected for funded graduate education after the Pay Grade 4 board is probably due in part to these officers having higher levels of human capital and in part due to a rational decision on the part of the Navy to only screen officers with command potential to obtain a graduate degree this late in a career. The estimated impact of a technical graduate degree, earned after the Pay Grade 4 board does not vary much when other factors, including early career

performance, are controlled for in the model. It should be noted that only a small number of officers actually obtain full-time technical education after the Pay Grade 4 board, which further highlights the possibility of a positive selection/screening effect.

Additionally, these officers may posses a higher motivation level or affective skill when compared to others. The effect of non-technical degrees earned at the same time in a career is insignificant. Furthermore, two separate logit regressions (see Appendix C) using "Technical Full-Time After" and "Non-Technical Full-Time After" as the dependent variables showed officers in the Technical Full-Time After category were more likely to serve in the squadron maintenance officer position.

Utilization of a Fully-Funded Degree. This covariate controls for utilization of a P-Code prior to the Pay Grade 5 board. While the impact is negative and significant, it becomes positive and insignificant once other factors are controlled for in Model Two. Those officers who utilize their degree are more likely to promote/screen and with degree utilization included in the model, it partially explains the positive premium to *full-time technical* after and *full-time non-technical before* estimates, causing their coefficients to be reduced in size. Only 19 of the 186 officers with FFGE actually utilize their P-code, but these officers are at least as likely to promote/screen as officers without graduate degrees.[10]

---

[10] Observed mean rate of promote/screen is 38.1% for officers without degrees. Officers who utilize their P-codes promote/screen at an observed rate of 36.8 percent.

The overall impact of utilization in the models shows that a utilization tour does not really hurt an officer's probability of promotion/command screen given they have good fitness report evaluations early in their career, holding all other factors constant.

Part-Time Graduate Education. Perhaps the most interesting effect in the specifications is the resilience of the part-time graduate education variable. While the coefficient only has half of the effect of the full-time graduate education covariates, it remains significant and positive in all specifications. The effect of part-time graduate education is reduced by approximately 24% when all controls are included in the final model. However, when you consider that officers who earn graduate degrees on their own time are more likely to hold the good jobs in a squadron and are also more likely to be recommended for accelerated promotion in Pay Grade 3, it is possible that these officers have a higher level of motivation than other officers. This coupled with the lower associated opportunity costs of part-time graduate education make this a viable option for those interested in continuing an aviation career and increasing their own human capital.

D. MARGINAL EFFECTS

To illustrate more clearly the effects of the independent variables in a logit regression, one may calculate the marginal effects for major covariates. For binary logit models, the logit coefficients are the log of the odds of a "1" outcome for the dependent variable (PROM_SCRN), holding constant the other variables. Since the coefficients are the log of the odds of the probability of promotion to Pay Grade 5/screen for squadron

93

command, some additional calculations are necessary to obtain the marginal effects of the independent variables. This is a four-step process (Bowman, 1998, p. 14):

(1) Calculate $Z = b_k * \bar{x}_k$, where:

b_k = logit coefficient for independent variable "k" and

$\bar{x}_k$ = intercept and mean values of independent variables

(2) Calculate $P(Y=1)=1/(1+e^{-z})$

(3) Calculate $P(Y=0) = 1 - P(Y=1)$

(4) Calculate "delta" (the marginal effect) = $b_k * [P(Y=1)*(1-P(Y=1))]$, or

"marginal effect" = $b_k * (P*(1-P))$

The calculations are performed with Excel™ and the results are displayed in the last column of Table 5.4. The calculations use the coefficients from Model Three in Table 5.3.

94

Table 5.4 – Marginal Effects of Promote/Screen

VARIABLES[a]	x̄	LOGIT	x̄ *LOGIT	MARGINAL LOGIT*P(1-P)
FFNTEARL	0.0216	-0.724	-0.0156	-15.50%
FFNTBEF	0.0128	0.9489	0.0121	20.31%
FFNTAFT+	0.0272	-0.2283	-0.0062	-4.89%
TECHEARL	0.0336	0.2911	0.0098	6.23%
TECHBEF	0.0088	0.286	0.0025	6.12%
TECHAFT+	0.0136	1.1326	0.0154	**24.25%**
PARTGRAD	0.2806	0.2653	0.0744	**5.68%**
GRADES	2.7794	-0.1737	-0.4828	**-3.72%**
BIOPHY	0.1407	-0.2492	-0.0351	-5.33%
MATH	0.0695	0.2003	0.0139	4.29%
SOCSCI	0.1815	0.0443	0.0080	0.95%
HUMNEC	0.2574	-0.43	-0.1107	**-9.21%**
BUSINESS	0.1855	0.3038	0.0563	6.50%
ROTC	0.1799	-0.2133	-0.0384	-4.57%
OCS	0.5084	-0.1596	-0.0811	-3.42%
Prior Enlisted	0.0392	-0.804	-0.0315	**-17.21%**
PILOT	0.6003	-0.0756	-0.0454	-1.62%
MAR0_1C	0.3293	0.7863	0.2590	**16.83%**
MAR_2PLS	0.5340	1.0698	0.5712	**22.90%**
ATTACK	0.3709	0.4118	0.1527	**8.82%**
CSJET	0.2246	0.2819	0.0633	6.03%
CSPROP	0.0855	-0.3717	-0.0318	-7.96%
MAINTOFF	0.4628	0.6931	0.3208	**14.84%**
OPSOFF	0.4492	0.6259	0.2812	**13.40%**
EVERUSE	0.0160	0.3429	0.0055	7.34%
PRAP3	0.4527	1.658	0.7506	**35.49%**
			-0.7979 =SUM x̄ *LOGIT	
		31.05%=	Est. Prob of Promote/Screen:	

a. The marginal effects are based on the logit coefficients estimated in column 4 of Table 5.4.

b. Significant covariates indicated in boldface.

The marginal effects reflect the impact of each independent variable on the probability of the outcome (promote/screen), holding all others constant at their mean values. Officers without graduate degrees are the constant in each of the regression models, making the values of the regression covariates a direct comparison to officers without graduate degrees. Table 5.4 and Figure 5.3 show that obtaining a technical

master's degree one or more years after the Pay Grade 4 board (TECHAFT+) increases the probability of promote/screen by 24.3 percentage points and completing a master's degree on one's own time (PART-TIME) increases an officers' chances by 5.7 percentage points when compared to officers without graduate degrees.

Figure 5.3

Marginal Effects of Graduate Education Covariates Evaluated at the Mean Values of X
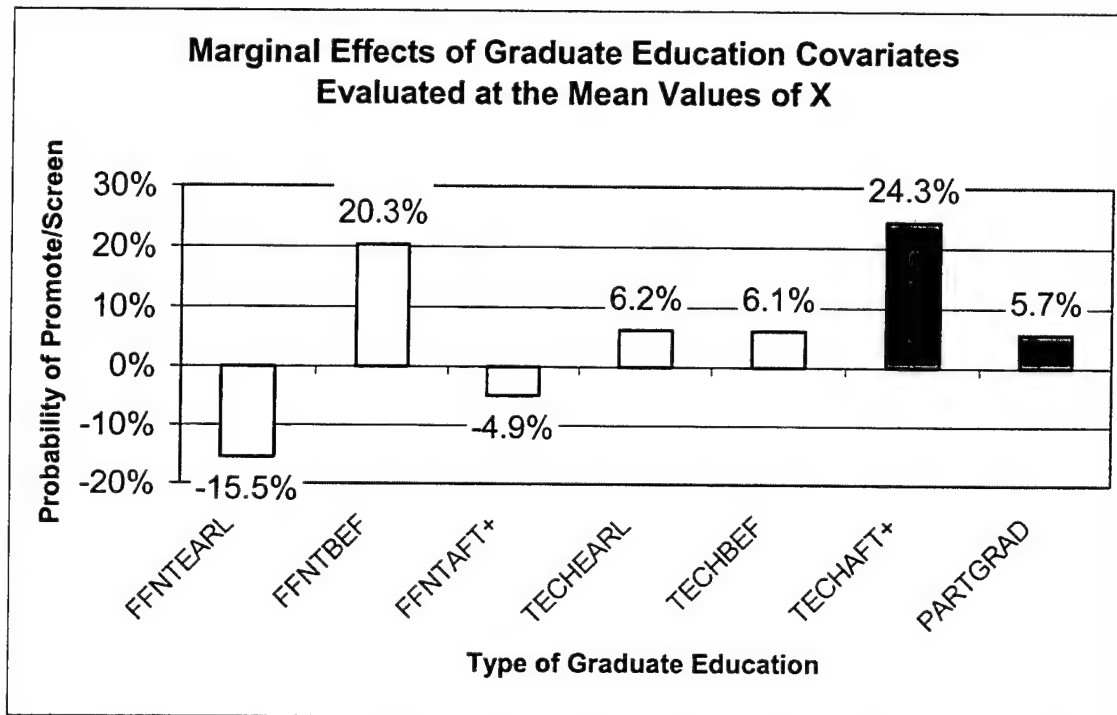
E. NOTIONAL PERSON

Using Table 5.4 it is possible to directly assess the effects of different values of the independent variables on overall probability of promote/screen. By setting the X-bar values equal to '0' or '1' for dummy variables, we can calculate the overall effects of different types of graduate education on the probability of promote/screen. Figure 5.4 displays the estimated probability of promote/screen given graduate degree type, timing, and technical specificity. The overall estimated probability of promote/screen when

96

calculated at the mean values of X is 31.05 percent, whereas the observed average value

of promote/screen is 38.8 percent.

Figure 5.4

Estimated Probability of Promote/Screen for Pay Grade 4 Officers by Graduate Degree Status (n=1,251)
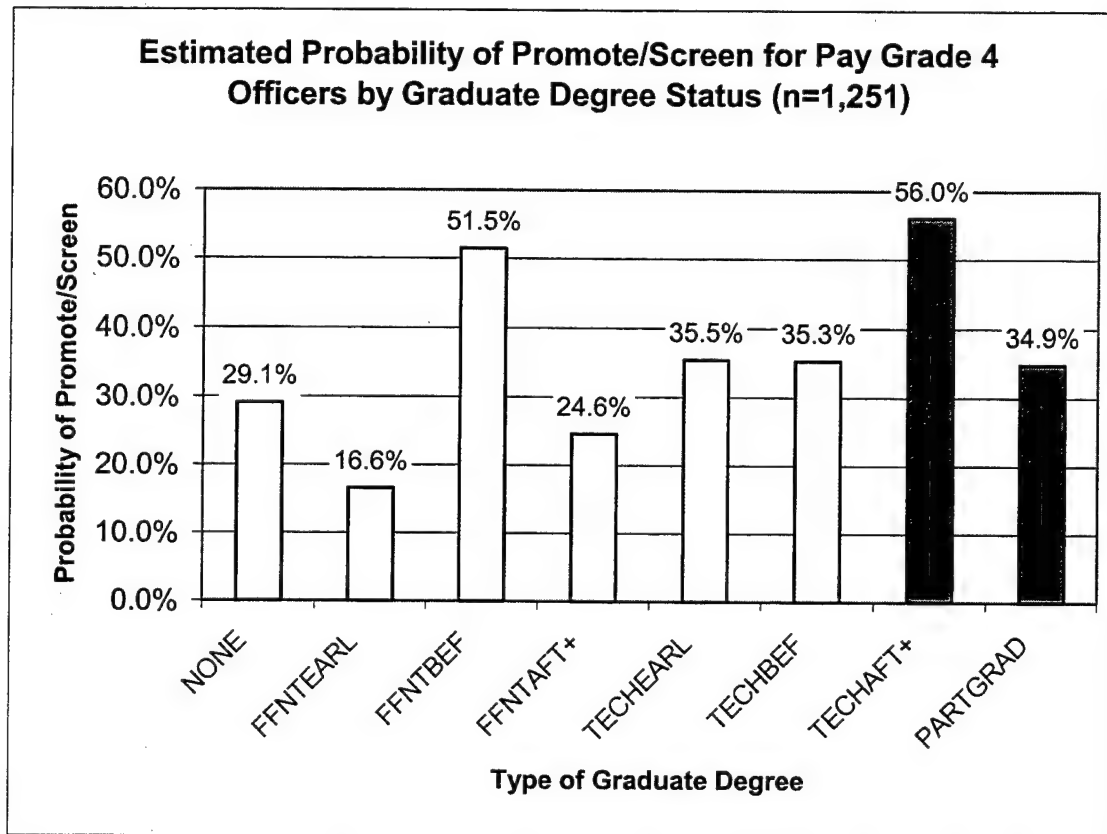
Figure 5.5 below displays the marginal effects of graduate degrees when

compared to officers without degrees. Officers without graduate education are estimated

to have a 29.1% probability of promote/screen. This number serves as the baseline for

computing the deltas and comparing graduate education covariates. Dark gray shading

indicates statistically significant categories. Officers with a fully funded technical degree

have a 26.9% better chance of promoting to Pay Grade 5/command screening than

officers without graduate degrees (i.e., 56.0 minus 29.1). Officers who earned degrees on

their own time are 5.8% more likely to realize the promote/screen outcome than officers

without degrees (i.e., 34.8 minus 29.1).

Figure 5.5

Marginal Effects of Graduate Education Covariates when Compared to Officers without Graduate Degrees (n=1,251)

The chart displays Delta (%) on the vertical axis versus Type of Graduate Degree on the horizontal axis. Values by category: FFNTEARL -12.5%, FFNTBEF 22.4%, FFNTAFT+ -4.5%, TECHEARL 6.3%, TECHBEF 6.2%, TECHAFT+ 26.9%, PARTGRAD 5.8%.
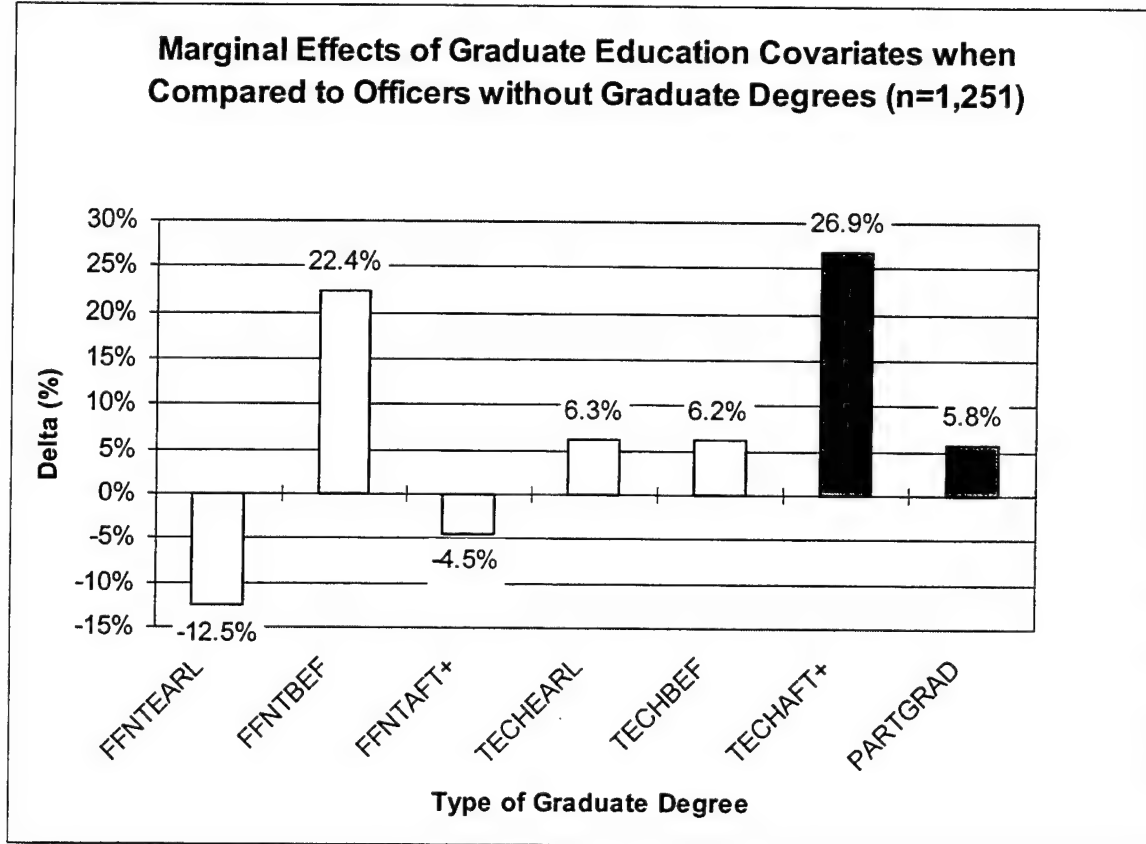
When one compares the differences between the regression marginal effects and

the unadjusted mean values for promote/screen the regression effects appear to reduce the

impact of graduate education. Figure 5.6 below illustrates this graphically.

Figure 5.6

Estimated Effects of Graduate Education Compared to the Observed Effects of X (n=1,251)
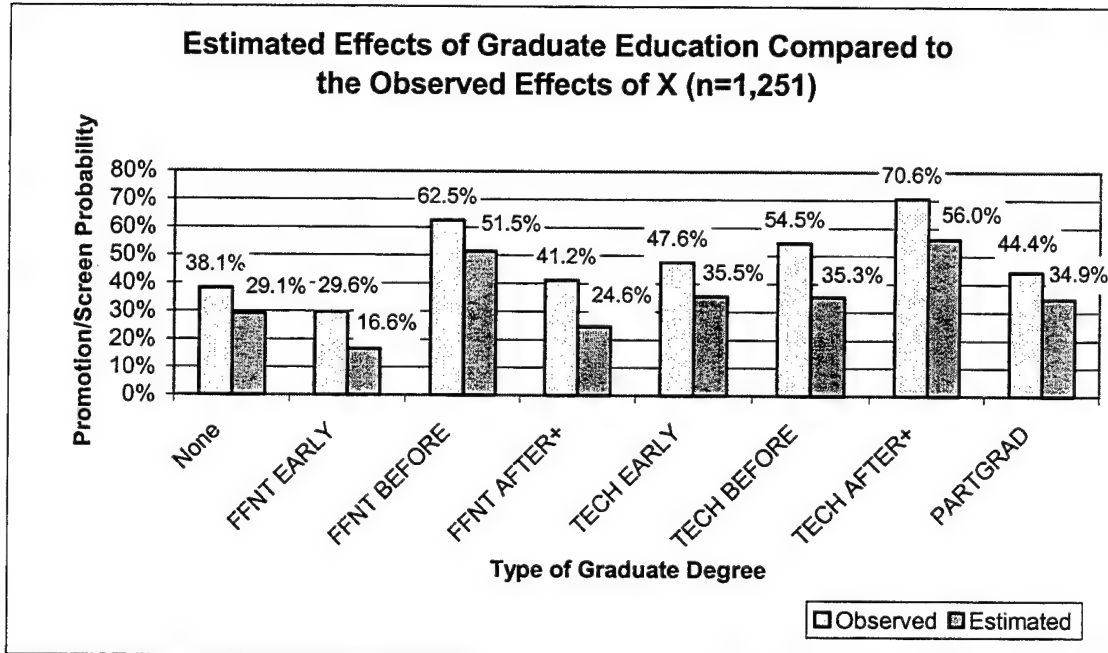
F.   SUMMARY

One value in performing regression analysis rather than calculating simple percentages is the ability to control for other factors. In the three model specifications we are able to evaluate the effects of other influences in an officer's career that make one officer different from the other, whether that is due to one's operational environment or individual behaviors. All of the variables in the final model have some statistical effect on officer performance. It is difficult to quantify behavioral characteristics, but through this analysis we are able to determine that graduate education for fixed-winged naval aviators does not hurt one's chances for advancement in a naval career and for some may enhance their chances for promotion and screening for command.

99

THIS PAGE INTENTIONALLY LEFT BLANK

VI.   CONCLUSIONS

This thesis examines the effects of graduate education on the joint outcome of promoting to commander and screening for squadron command for carrier-based, fixed-wing aviators. Logit models indicate that officers who earn a graduate degree one or more years after the Pay Grade 4 board in a technical program, have a 26.9 percentage point greater chance to promote/screen than officers without a degree. Furthermore, officers who earn a graduate degree on their own time have a 5.8 percentage point better chance to promote/screen than officers without a degree. These two findings are evidence of a direct benefit realized by officers in these types of degree programs.

However, the most significant finding of this study is that in no instance does fully funded graduate education hurt one's career. The community of carrier-based fixed-wing aviation is chosen as the basis for this study due to perceptions throughout this community that time spent away from flying duty can be detrimental to one's career. The opportunity cost of attending fully funded graduate education can be significant when an officer is removed from a flying billet and also receives 2 to 3 years of unobserved, non-competitive fitness reports. But the statistical models demonstrate that even when controls for prior performance, personal background, and Navy experiences are accounted for, the coefficients for graduate education never become negative and significant. If funded graduate degrees and graduate degrees earned on officers' own time do not adversely affect a naval career, then a reasonable assertion is that graduate education is definitely beneficial to the naval officer.

When considering the benefits realized by the Navy, an earlier study (Cymrot & Cavalluzzo, 1998) called into question the benefits of P-code utilization, due to the low rates of actual utilization of funded graduate education. In this data, only 10.2% of the 186 aviators with FFGE utilized their degree prior to the Pay Grade 5 board. The overall impact of utilization in the models shows that a utilization tour does not really hurt an officer's probability of promotion/command screen given they have good fitness report evaluations early in their career, holding all other factors constant. The officers who utilize a degree are at least as likely to promote/screen as officers without graduate degrees, reinforcing the importance of good performance in an assigned billet.

Mean values of promotion rates and representation at flag rank are also common metrics used to justify or rebuke the need for graduate education. The fundamental problem with these methods lies in their limited ability to measure human behavior.

For a line community such as carrier aviation, methods of problem solving and employing the operational art of strike warfare often lie in variances of human behavior. The indirect benefit of graduate education is in its effect on problem solving, applying new approaches to old problems, or even exposure to different philosophies on management styles. This is a broad concept, but it highlights the difficulties of placing an absolute metric on the value of education.

The Navy realizes a direct benefit in officer retention due to the increased commitment incurred from attending a funded graduate education program. The immeasurable effect comes from officers early in their career who view the option of

funded graduate education as a reason to prolong a naval career, if only to bolster personal skill levels before entering the civilian world.

This study has demonstrated that graduate education is beneficial to the officer if for no other reason than achieving a higher level of education on a full scholarship, in addition to salary and non-pecuniary benefits. The benefit is further realized when an officer can fit graduate education into a career without fear of decreasing opportunity when compared to their peers without graduate degrees.

A.   POLICY RECOMMENDATIONS

As a result of the findings in this thesis, several policy recommendations appear to be warranted.

1) Continue to make graduate education, of all kinds, available to all officers. This especially applies to the unrestricted line communities. Due to the significance of earning a graduate degree on one's own time, the Navy should expand funding opportunities for distance education and make graduate level courses available on ships and shore installations, similar to the current distance learning opportunities afforded enlisted personnel. Current programs allow officers to work on graduate courses, but only during off-duty hours while in a shore-based billet.

2) Continue to sponsor the Naval Postgraduate School as the flagship higher learning institution in the Navy. While earning a graduate degree through distance learning technology has its advantages, it does not replace the effect of total immersion in a graduate studies program. The NPS still has a valid role in providing naval-relevant

courses of study that benefit the Navy in the way of applied student projects and master's theses.

3) Explore new ways to make graduate education beneficial to both the officer and the Navy. The Leadership, Education, and Development (LEAD) program for prospective company officers at the United States Naval Academy is an example of one such program. After one year of immersion, officers immediately utilize their degree as USNA company officers. Perhaps executive MBA-type courses could be implemented for prospective department heads or commanding officers. These courses could be taught at a central facility or use video-teleconferencing technologies to create a virtual classroom with participants based around the world.

B.   RECOMMENDATIONS FOR FURTHER RESEARCH

This thesis has examined the effects of fully funded graduate education on promotion/command screen. Follow-on research should focus on a similar evaluation of graduate education using more recent data through 2000. This will be especially relevant due to current and projected manpower shortages throughout the fleet since the drawdown of the mid-nineties. Another area for future analysis involves a survey of past and present aviation department heads, commanding officers, and air wing commanders with graduate degrees and assess the perceived benefits or disadvantages that a master's degree provides during an operational tour in a position of leadership.

The bottom line is the Navy is in a position to expand its present capabilities by drawing on the talents of its officers. By focusing its efforts on education, as well as

training, the Navy can truly promote an environment of lifelong learning and realize its

full potential as the force of the future.

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX A: BIVARIATE CORRELATIONS

This appendix contains bivariate correlations of covariates used in Table 5.3. This was to test for possible significant correlation between the PRAP3 covariate and others included in the final logit model.

BIVARIATE CORRELATIONS FOR PRAP3 AND PROM_SCR

Correlations

		PRAP3	PROM_SCR	FFNTEARL	FFNTBEF	FFNTAFT1	NOGRAD
PRAP3	Pearson Correlation	1.000	.301**	.071*	-.001	.028	-.051
	Sig. (2-tailed)	.	.000	.012	.960	.323	.070
	N	1251	1251	1251	1251	1251	1251
PROM_SCR	Pearson Correlation	.301**	1.000	-.031	.053	.005	-.040
	Sig. (2-tailed)	.000	.	.275	.062	.869	.154
	N	1251	1251	1251	1251	1251	1251
FFNTEARL	Pearson Correlation	.071*	-.031	1.000	-.017	-.025	-.171**
	Sig. (2-tailed)	.012	.275	.	.550	.380	.000
	N	1251	1251	1251	1251	1251	1251
FFNTBEF	Pearson Correlation	-.001	.053	-.017	1.000	-.019	-.131**
	Sig. (2-tailed)	.960	.062	.550	.	.501	.000
	N	1251	1251	1251	1251	1251	1251
FFNTAFT1	Pearson Correlation	.028	.005	-.025	-.019	1.000	-.193**
	Sig. (2-tailed)	.323	.869	.380	.501	.	.000
	N	1251	1251	1251	1251	1251	1251
NOGRAD	Pearson Correlation	-.051	-.040	-.171**	-.131**	-.193**	1.000
	Sig. (2-tailed)	.070	.154	.000	.000	.000	.
	N	1251	1251	1251	1251	1251	1251

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Correlations

		PRAP3	PROM_SCR	TECHEARL	TECHBEF	TECHAFT1	NOGRAD
PRAP3	Pearson Correlation	1.000	.274**	-.003	-.026	.015	-.046
	Sig. (2-tailed)	.	.000	.916	.322	.559	.083
	N	1423	1423	1423	1423	1423	1423
PROM_SCR	Pearson Correlation	.274**	1.000	.034	.042	.077**	-.067**
	Sig. (2-tailed)	.000	.	.145	.075	.001	.004
	N	1423	1817	1817	1817	1817	1817
TECHEARL	Pearson Correlation	-.003	.034	1.000	-.015	-.024	-.190**
	Sig. (2-tailed)	.916	.145	.	.522	.312	.000
	N	1423	1817	1817	1817	1817	1817
TECHBEF	Pearson Correlation	-.026	.042	-.015	1.000	-.013	-.105**
	Sig. (2-tailed)	.322	.075	.522	.	.575	.000
	N	1423	1817	1817	1817	1817	1817
TECHAFT1	Pearson Correlation	.015	.077**	-.024	-.013	1.000	-.167**
	Sig. (2-tailed)	.559	.001	.312	.575	.	.000
	N	1423	1817	1817	1817	1817	1817
NOGRAD	Pearson Correlation	-.046	-.067**	-.190**	-.105**	-.167**	1.000
	Sig. (2-tailed)	.083	.004	.000	.000	.000	.
	N	1423	1817	1817	1817	1817	1817

**. Correlation is significant at the 0.01 level (2-tailed).

Correlations

		PROM_SCR	PRAP3	APC1
PROM_SCR	Pearson Correlation	1.000	.301**	-.065*
	Sig. (2-tailed)	.	.000	.021
	N	1251	1251	1251
PRAP3	Pearson Correlation	.301**	1.000	-.077**
	Sig. (2-tailed)	.000	.	.006
	N	1251	1251	1251
APC1	Pearson Correlation	-.065*	-.077**	1.000
	Sig. (2-tailed)	.021	.006	.
	N	1251	1251	1251

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Correlations

		PROM_SCR	PRAP3	ENGINEER	MATH	BIOPHY	SOCSCI	BUSINESS	HUMNEC
PROM_SCR	Pearson Correlation	1.000	.301**	-.033	.028	-.038	-.002	.049	-.001
	Sig. (2-tailed)	.	.000	.250	.322	.181	.956	.084	.981
	N	1251	1251	1251	1251	1251	1251	1251	1251
PRAP3	Pearson Correlation	.301**	1.000	-.060*	-.025	.003	-.003	.039	.031
	Sig. (2-tailed)	.000	.	.033	.379	.905	.902	.167	.266
	N	1251	1251	1251	1251	1251	1251	1251	1251
ENGINEER	Pearson Correlation	-.033	-.060*	1.000	-.122**	-.180**	-.210**	-.212**	-.262**
	Sig. (2-tailed)	.250	.033	.	.000	.000	.000	.000	.000
	N	1251	1251	1251	1251	1251	1251	1251	1251
MATH	Pearson Correlation	.028	-.025	-.122**	1.000	-.111**	-.129**	-.130**	-.161**
	Sig. (2-tailed)	.322	.379	.000	.	.000	.000	.000	.000
	N	1251	1251	1251	1251	1251	1251	1251	1251
BIOPHY	Pearson Correlation	-.038	.003	-.180**	-.111**	1.000	-.191**	-.193**	-.238**
	Sig. (2-tailed)	.181	.905	.000	.000	.	.000	.000	.000
	N	1251	1251	1251	1251	1251	1251	1251	1251
SOCSCI	Pearson Correlation	-.002	-.003	-.210**	-.129**	-.191**	1.000	-.225**	-.277**
	Sig. (2-tailed)	.956	.902	.000	.000	.000	.	.000	.000
	N	1251	1251	1251	1251	1251	1251	1251	1251
BUSINESS	Pearson Correlation	.049	.039	-.212**	-.130**	-.193**	-.225**	1.000	-.281**
	Sig. (2-tailed)	.084	.167	.000	.000	.000	.000	.	.000
	N	1251	1251	1251	1251	1251	1251	1251	1251
HUMNEC	Pearson Correlation	-.001	.031	-.262**	-.161**	-.238**	-.277**	-.281**	1.000
	Sig. (2-tailed)	.981	.266	.000	.000	.000	.000	.000	.
	N	1251	1251	1251	1251	1251	1251	1251	1251

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

109

Correlations

		PROM_SCR	PRAP3	ROTC_R	OCS	ENL_RES	USNA
PROM_SCR	Pearson Correlation	1.000	.301**	.010	-.023	-.063*	.045
	Sig. (2-tailed)	.	.000	.715	.407	.025	.112
	N	1251	1251	1251	1251	1251	1251
PRAP3	Pearson Correlation	.301**	1.000	-.035	.014	-.037	.031
	Sig. (2-tailed)	.000	.	.212	.628	.194	.272
	N	1251	1251	1251	1251	1251	1251
ROTC_R	Pearson Correlation	.010	-.035	1.000	-.476**	-.095**	-.287**
	Sig. (2-tailed)	.715	.212	.	.000	.001	.000
	N	1251	1251	1251	1251	1251	1251
OCS	Pearson Correlation	-.023	.014	-.476**	1.000	-.205**	-.623**
	Sig. (2-tailed)	.407	.628	.000	.	.000	.000
	N	1251	1251	1251	1251	1251	1251
ENL_RES	Pearson Correlation	-.063*	-.037	-.095**	-.205**	1.000	-.124**
	Sig. (2-tailed)	.025	.194	.001	.000	.	.000
	N	1251	1251	1251	1251	1251	1251
USNA	Pearson Correlation	.045	.031	-.287**	-.623**	-.124**	1.000
	Sig. (2-tailed)	.112	.272	.000	.000	.000	.
	N	1251	1251	1251	1251	1251	1251

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Correlations

		PROM_SCR	PRAP3	ATTACK	CSJET	CSPROP	FIGHTER
PROM_SCR	Pearson Correlation	1.000	.301**	.058*	.012	-.085**	-.020
	Sig. (2-tailed)	.	.000	.039	.664	.003	.470
	N	1251	1251	1251	1251	1251	1251
PRAP3	Pearson Correlation	.301**	1.000	-.037	-.024	.001	.059*
	Sig. (2-tailed)	.000	.	.190	.402	.963	.037
	N	1251	1251	1251	1251	1251	1251
ATTACK	Pearson Correlation	.058*	-.037	1.000	-.413**	-.235**	-.525**
	Sig. (2-tailed)	.039	.190	.	.000	.000	.000
	N	1251	1251	1251	1251	1251	1251
CSJET	Pearson Correlation	.012	-.024	-.413**	1.000	-.165**	-.368**
	Sig. (2-tailed)	.664	.402	.000	.	.000	.000
	N	1251	1251	1251	1251	1251	1251
CSPROP	Pearson Correlation	-.085**	.001	-.235**	-.165**	1.000	-.209**
	Sig. (2-tailed)	.003	.963	.000	.000	.	.000
	N	1251	1251	1251	1251	1251	1251
FIGHTER	Pearson Correlation	-.020	.059*	-.525**	-.368**	-.209**	1.000
	Sig. (2-tailed)	.470	.037	.000	.000	.000	.
	N	1251	1251	1251	1251	1251	1251

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Correlations

		PROM_SCR	PRAP3	MAR_2PLS	MAR0_1C	SING_DIV
PROM_SCR	Pearson Correlation	1.000	.301**	.151**	-.004	-.100**
	Sig. (2-tailed)	.	.000	.000	.901	.000
	N	1251	1251	1251	1251	1251
PRAP3	Pearson Correlation	.301**	1.000	.080**	.005	-.043
	Sig. (2-tailed)	.000	.	.005	.869	.129
	N	1251	1251	1251	1251	1251
MAR_2PLS	Pearson Correlation	.151**	.080**	1.000	-.689**	-.302**
	Sig. (2-tailed)	.000	.005	.	.000	.000
	N	1251	1251	1251	1251	1251
MAR0_1C	Pearson Correlation	-.004	.005	-.689**	1.000	-.223**
	Sig. (2-tailed)	.901	.869	.000	.	.000
	N	1251	1251	1251	1251	1251
SING_DIV	Pearson Correlation	-.100**	-.043	-.302**	-.223**	1.000
	Sig. (2-tailed)	.000	.129	.000	.000	.
	N	1251	1251	1251	1251	1251

**. Correlation is significant at the 0.01 level (2-tailed).

Correlations

		PROM_SCR	PRAP3	P1PILOT	MAINTOFF	OPSOFF
PROM_SCR	Pearson Correlation	1.000	.301**	-.023	.192**	.155**
	Sig. (2-tailed)	.	.000	.412	.000	.000
	N	1251	1251	1251	1251	1251
PRAP3	Pearson Correlation	.301**	1.000	-.002	.048	.092**
	Sig. (2-tailed)	.000	.	.952	.093	.001
	N	1251	1251	1251	1251	1251
P1PILOT	Pearson Correlation	-.023	-.002	1.000	.014	-.008
	Sig. (2-tailed)	.412	.952	.	.610	.783
	N	1251	1251	1251	1251	1251
MAINTOFF	Pearson Correlation	.192**	.048	.014	1.000	.025
	Sig. (2-tailed)	.000	.093	.610	.	.369
	N	1251	1251	1251	1251	1251
OPSOFF	Pearson Correlation	.155**	.092**	-.008	.025	1.000
	Sig. (2-tailed)	.000	.001	.783	.369	.
	N	1251	1251	1251	1251	1251

**. Correlation is significant at the 0.01 level (2-tailed).

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX B: FIVE-STEP REGRESSION TABLE

This appendix contains a five-step regression table which highlights the impacts to graduate education coefficients as controls for self-selection, as well as pre- and post-commissioning factors are added to the model.

Table A-1 – Dependent Variable = Promote/Screen[a, b, c]

Variables	1	2	3	4
FFNTEARL	-0.067	-0.528	-0.356	-0.724
	(0.379)	(0.427)	(0.435)	(0.486)
FFNTBEF	**1.041****	**0.916***	**1.03****	0.949
	(0.425)	(0.501)	(0.514)	(0.624)
FFNTAFT+	0.393	0.005	0.045	-0.228
	(0.254)	(0.363)	(0.372)	(0.409)
TECHEARL	**0.636****	0.428	0.43	0.291
	(0.305)	(0.317)	(0.325)	(0.381)
TECHBEF	**1.05****	0.393	0.535	0.286
	(0.534)	(0.587)	(0.597)	(0.683)
TECHAFT+	**1.184*****	**1.157****	**1.074****	**1.133***
	(0.342)	(0.502)	(0.507)	(0.58)
PARTGRAD	**0.59*****	**0.486*****	**0.506*****	**0.265***
	(0.120)	(0.133)	(0.137)	(0.156)
EVERUSE	0.029	0.206	0.319	0.343
	(0.491)	(0.519)	(0.548)	(0.567)
APC1	–	**-0.132***	**-0.127***	**-0.174****
		(0.068)	(0.07)	(0.082)
BIOPHY[d]	--	-0.106	-0.037	-0.249
		(0.221)	(0.227)	(0.253)
MATH	--	0.172	0.219	0.200
		(0.263)	(0.272)	(0.314)
SOCSCI	--	0.107	0.226	0.044
		(0.205)	(0.211)	(0.241)
HUMNEC	--	**-0.316***	-0.194	**-0.430***
		(0.197)	(0.202)	(0.233)
BUSINESS	--	0.316	**0.429****	0.304
		(0.202)	(0.207)	(0.235)
ROTC[e]	--	**-0.339***	-0.283	-0.213
		(0.184)	(0.189)	(0.213)
OCS	--	**-0.276***	-0.174	-0.16
		(0.148)	(0.152)	(0.172)
ENL_RES	--	**-1.333*****	**-1.149*****	**-0.804***
		(0.353)	(0.363)	(0.425)
MAR0_1C[f]	--	**0.935*****	**0.875*****	**0.786*****
		(0.196)	(0.199)	(0.229)
MAR_2PLS	--	**1.174*****	**1.117*****	**1.070*****
		(0.187)	(0.191)	(0.22)
PILOT	–	–	-0.104	-0.076
			(0.124)	(0.142)
ATTACK[g]	–	–	**0.252***	**0.412****
			(0.144)	(0.167)
CSJET	–	–	0.165	0.282
			(0.163)	(0.189)
CSPROP	–	–	**-0.437***	-0.372
			(0.252)	(0.29)
MAINTOFF	–	--	**0.644*****	**0.693*****
			(0.119)	(0.138)
OPSOFF	–	–	**0.513*****	**0.626*****
			(0.118)	(0.137)
PRAP3	--	--	–	**1.658*****
				(0.184)
Constant	-1.055	-1.147	-1.849	-2.334
-2 Log Likelihood	2181.339	1767.171	1706.983	1305.704
	n=1,817	n=1,522	n=1,522	n=1,251

g. Standard Errors in parentheses
h. All models incorporate fiscal year dummies with FY84 as the omitted category.
i. Statisctical significance indicated as follows: *=0.10, **=0.05, ***=0.01.
j. Engineering major is the omitted category.
k. USNA is the omitted category.
l. Single/Divorced is the omitted category.
m. Fighter community is the omitted category.

116

APPENDIX C: REGRESSIONS FOR GRADUATE DEGREES EARNED ONE TO FOUR YEARS AFTER THE PAY GRADE 4 BOARD

This appendix contains the two regressions to analyze any potential differences

between a technical and non-technical degree earned one to four years after the Pay Grade

4 board.

LOGISTIC REGRESSION ON FFNTAFT+

```
        Total number of cases:        325 (Unweighted)
        Number of selected cases:     325
        Number of unselected cases: 0

        Number of selected cases:                   325
        Number rejected because of missing data:    139
        Number of cases included in the analysis:   186

Dependent Variable..    FFNTAFT1

-2 Log Likelihood    176.92557

* Constant is included in the model.

--------------------- Variables in the Equation ----------------------
```

Variable	B	S.E.	Wald	df	Sig	R	Exp(B)
PROMFY81	7.0015	30.7307	.0519	1	.8198	.0000	1098.2771
PROMFY82	6.3227	30.7346	.0423	1	.8370	.0000	557.0907
PROMFY83	6.2696	30.7304	.0416	1	.8383	.0000	528.2576
PROMFY84	6.5565	30.7352	.0455	1	.8311	.0000	703.8247
PROMFY85	5.7639	30.7325	.0352	1	.8512	.0000	318.5888
PROMFY86	6.2053	30.7304	.0408	1	.8400	.0000	495.3443
PROMFY87	6.5447	30.7337	.0453	1	.8314	.0000	695.5266
PROMFY88	5.5884	30.7320	.0331	1	.8557	.0000	267.3084
APC1	-.7127	.2943	5.8658	1	.0154	-.1478	.4903
BIOPHY	-.6486	.8610	.5676	1	.4512	.0000	.5228
MATH	-.2723	.7824	.1211	1	.7278	.0000	.7616
SOCSCI	-8.2333	19.3129	.1817	1	.6699	.0000	.0003
HUMNEC	-.9863	.6975	1.9996	1	.1573	.0000	.3729
BUSINESS	-2.0421	1.2693	2.5884	1	.1076	-.0577	.1298
ROTC_R	-.3126	.6398	.2388	1	.6251	.0000	.7315
OCS	-1.9837	.8088	6.0154	1	.0142	-.1506	.1376
ENL_RES	-.6914	1.0505	.4332	1	.5104	.0000	.5009
P1PILOT	-.1907	.5101	.1397	1	.7086	.0000	.8264
MAR0_1C	-1.2014	.7729	2.4161	1	.1201	-.0485	.3008
MAR_2PLS	.0006	.6719	.0000	1	1.0000	.0000	1.0006
ATTACK	-1.1742	.5643	4.3301	1	.0374	-.1148	.3091
CSJET	-.7405	.6655	1.2380	1	.2659	.0000	.4769
CSPROP	-1.8743	1.2579	2.2201	1	.1362	-.0353	.1535
MAINTOFF	.2281	.4946	.2126	1	.6447	.0000	1.2562
OPSOFF	.3687	.4883	.5699	1	.4503	.0000	1.4458
EVERUSE	.0667	.9858	.0046	1	.9460	.0000	1.0690
PRAP3	.3367	.5868	.3292	1	.5661	.0000	1.4003
Constant	-4.0970	30.7462	.0178	1	.8940		

LOGISTIC REGRESSION ON TECHAFT+

```
         Total number of cases:        325 (Unweighted)
         Number of selected cases:     325
         Number of unselected cases: 0

         Number of selected cases:                    325
         Number rejected because of missing data:     139
         Number of cases included in the analysis:    186
```

Dependent Variable..   TECHAFT1

-2 Log Likelihood   113.74274

* Constant is included in the model.

--------------------- Variables in the Equation ----------------------

Variable	B	S.E.	Wald	df	Sig	R	Exp(B)
PROMFY81	9.9854	87.8018	.0129	1	.9095	.0000	21706.358
PROMFY82	10.0905	87.8011	.0132	1	.9085	.0000	24113.345
PROMFY83	.3383	103.4270	.0000	1	.9974	.0000	1.4026
PROMFY84	9.2046	87.8058	.0110	1	.9165	.0000	9942.7802
PROMFY85	9.8831	87.8045	.0127	1	.9104	.0000	19596.521
PROMFY86	9.8026	87.8021	.0125	1	.9111	.0000	18080.543
PROMFY87	8.8725	87.8060	.0102	1	.9195	.0000	7133.1657
PROMFY88	9.1345	87.8033	.0108	1	.9171	.0000	9269.4909
APC1	-.6516	.4751	1.8813	1	.1702	.0000	.5212
BIOPHY	7.6658	39.8150	.0371	1	.8473	.0000	2134.0226
MATH	7.8816	39.8133	.0392	1	.8431	.0000	2647.9835
SOCSCI	10.2894	39.8034	.0668	1	.7960	.0000	29418.929
HUMNEC	8.2056	39.8049	.0425	1	.8367	.0000	3661.2761
BUSINESS	9.4951	39.8056	.0569	1	.8115	.0000	13293.807
ROTC_R	.5119	1.0025	.2607	1	.6096	.0000	1.6684
OCS	.2447	.9001	.0739	1	.7858	.0000	1.2772
ENL_RES	-8.3808	67.1839	.0156	1	.9007	.0000	.0002
P1PILOT	-.3202	.6940	.2128	1	.6445	.0000	.7260
MAR0_1C	1.5479	1.0819	2.0470	1	.1525	.0203	4.7014
MAR_2PLS	.5848	.9762	.3588	1	.5491	.0000	1.7946
ATTACK	-.3945	.8497	.2156	1	.6424	.0000	.6740
CSJET	-.3468	.9910	.1225	1	.7264	.0000	.7069
CSPROP	.7289	1.1572	.3968	1	.5287	.0000	2.0729
MAINTOFF	1.2697	.7421	2.9274	1	.0871	.0903	3.5597
OPSOFF	-.1696	.6891	.0606	1	.8056	.0000	.8440
EVERUSE	.3318	1.1711	.0803	1	.7769	.0000	1.3935
PRAP3	-.3930	.8114	.2346	1	.6282	.0000	.6750
Constant	-19.9445	96.4060	.0428	1	.8361		

118

APPENDIX D: T-TESTS

This appendix contains t-tests used in the analysis contained in Chapter IV and Chapter V.

Group Statistics

	GRAD3CAT	N	Mean	Std. Deviation	Std. Error Mean
PROM_SCR	FFGE	186	.3763	.4858	.0356
	None	714	.3810	.4860	.0182
ACADEMIC PROFILE CODE 1	FFGE	186	2.3226	.8531	.0626
	None	714	2.9398	.8609	.0322
ENGINEER	FFGE	186	.2097	.4082	.0299
	None	714	.1695	.3754	.0141
MATH	FFGE	186	.1022	.3037	.0223
	None	714	.0630	.2432	.0091
BIOPHY	FFGE	186	.0968	.2964	.0217
	None	714	.1373	.3444	.0129
SOCSCI	FFGE	186	.1129	.3173	.0233
	None	714	.1919	.3941	.0147
BUSINESS	FFGE	186	.1398	.3477	.0255
	None	714	.2213	.4154	.0155
HUMNEC	FFGE	186	.3387	.4745	.0348
	None	714	.2171	.4126	.0154
source--rotc college program	FFGE	186	.2204	.4157	.0305
	None	714	.1597	.3666	.0137
source--ocs	FFGE	186	.3333	.4727	.0347
	None	714	.5574	.4970	.0186
source--enl reserve other	FFGE	186	.0591	.2365	.0173
	None	714	.0350	.1839	.0069
source--usna	FFGE	186	.3871	.4884	.0358
	None	714	.2479	.4321	.0162
MAR_2PLS	FFGE	186	.5753	.4956	.0363
	None	714	.4930	.5003	.0187
MAR0_1C	FFGE	186	.3065	.4623	.0339
	None	714	.3529	.4782	.0179
SING_DIV	FFGE	186	.1129	.3173	.0233
	None	714	.0952	.2937	.0110
ATTACK	FFGE	186	.4247	.4956	.0363
	None	714	.3641	.4815	.0180
CSJET	FFGE	186	.1882	.3919	.0287
	None	714	.2367	.4254	.0159
CSPROP	FFGE	186	.0914	.2890	.0212
	None	714	.0798	.2712	.0102
FIGHTER	FFGE	186	.2957	.4576	.0336
	None	714	.3193	.4665	.0175
calc. from pildesyr & hpildsyr	FFGE	186	.5860	.4939	.0362
	None	714	.5812	.4937	.0185
N1NFO	FFGE	186	.4140	.4939	.0362
	None	714	.4188	.4937	.0185
MAINTOFF	FFGE	186	.3817	.4871	.0357
	None	714	.4734	.4996	.0187
OPSOFF	FFGE	186	.4194	.4948	.0363
	None	714	.4468	.4975	.0186
PRAP3	FFGE	186	.4559	.4122	.0302
	None	714	.4356	.3781	.0141

120

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
PROM_SCR	Equal variances assumed	.054	.816	-.115	898	.908	-.0046	.0400	-.0831	.0739
	Equal variances not assumed			-.115	289	.908	-.0046	.0400	-.0833	.0741
ACADEMIC PROFILE CODE 1	Equal variances assumed	1.791	.181	-8.725	898	.000	-.6172	.0707	-.7560	-.4784
	Equal variances not assumed			-8.772	291	.000	-.6172	.0704	-.7557	-.4787
ENGINEER	Equal variances assumed	6.082	.014	1.277	898	.202	.0402	.0315	-.0216	.1020
	Equal variances not assumed			1.216	272	.225	.0402	.0331	-.0249	.1053
MATH	Equal variances assumed	13.149	.000	1.851	898	.065	.0391	.0211	-.0024	.0806
	Equal variances not assumed			1.627	250	.105	.0391	.0241	-.0082	.0865
BIOPHY	Equal variances assumed	9.253	.002	-1.468	898	.143	-.0405	.0276	-.0946	.0137
	Equal variances not assumed			-1.602	327	.110	-.0405	.0253	-.0902	.0092
SOCSCI	Equal variances assumed	30.027	.000	-2.528	898	.012	-.0790	.0312	-.1403	-.0177
	Equal variances not assumed			-2.867	349	.004	-.0790	.0275	-.1332	-.0248
BUSINESS	Equal variances assumed	28.840	.000	-2.460	898	.014	-.0815	.0331	-.1465	-.0165
	Equal variances not assumed			-2.729	336	.007	-.0815	.0299	-.1402	-.0228

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
HUMNEC	Equal variances assumed	35.822	.000	3.468	898	.001	.1216	.0351	.0528	.1905
	Equal variances not assumed			3.195	262	.002	.1216	.0381	.0467	.1966
source--rotc college program	Equal variances assumed	13.831	.000	1.957	898	.051	.0608	.0311	-.0002	.1217
	Equal variances not assumed			1.818	265	.070	.0608	.0334	-.0050	.1266
source--ocs	Equal variances assumed	45.930	.000	-5.531	898	.000	-.2241	.0405	-.3036	-.1446
	Equal variances not assumed			-5.697	300	.000	-.2241	.0393	-.3015	-.1467
source--enl reserve other	Equal variances assumed	8.756	.003	1.496	898	.135	.0241	.0161	-.0075	.0558
	Equal variances not assumed			1.293	246	.197	.0241	.0187	-.0126	.0609
source--usna	Equal variances assumed	37.910	.000	3.806	898	.000	.1392	.0366	.0674	.2110
	Equal variances not assumed			3.543	265	.000	.1392	.0393	.0618	.2166
MAR_2PLS	Equal variances assumed	15.700	.000	2.001	898	.046	.0823	.0411	.0016	.1629
	Equal variances not assumed			2.012	291	.045	.0823	.0409	.0018	.1627
MAR0_1C	Equal variances assumed	6.635	.010	-1.189	898	.235	-.0465	.0391	-.1232	.0303
	Equal variances not assumed			-1.213	297	.226	-.0465	.0383	-.1219	.0289

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
SING_DIV	Equal variances assumed	2.014	.156	.718	898	.473	.0177	.0246	-.0306	.0659
	Equal variances not assumed			.686	273	.493	.0177	.0257	-.0330	.0683
ATTACK	Equal variances assumed	6.552	.011	1.519	898	.129	.0606	.0399	-.0177	.1389
	Equal variances not assumed			1.494	283	.136	.0606	.0406	-.0193	.1404
CSJET	Equal variances assumed	8.816	.003	-1.408	898	.160	-.0485	.0345	-.1162	.0191
	Equal variances not assumed			-1.477	308	.141	-.0485	.0329	-.1132	.0161
CSPROP	Equal variances assumed	1.028	.311	.511	898	.610	.0116	.0226	-.0329	.0560
	Equal variances not assumed			.492	276	.623	.0116	.0235	-.0347	.0578
FIGHTER	Equal variances assumed	1.641	.201	-.618	898	.537	-.0236	.0383	-.0987	.0515
	Equal variances not assumed			-.625	293	.533	-.0236	.0378	-.0981	.0508
calc. from plldesyr & hplldsyr	Equal variances assumed	.057	.811	.118	898	.906	.0048	.0406	-.0750	.0846
	Equal variances not assumed			.118	289	.906	.0048	.0407	-.0752	.0848
N1NFO	Equal variances assumed	.057	.811	-.118	898	.906	-.0048	.0406	-.0846	.0750
	Equal variances not assumed			-.118	289	.906	-.0048	.0407	-.0848	.0752

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
MAINTOFF	Equal variances assumed	31.581	.000	-2.240	898	.025	-.0917	.0409	-.1720	-.0114
	Equal variances not assumed			-2.274	295	.024	-.0917	.0403	-.1710	-.0123
OPSOFF	Equal variances assumed	2.248	.134	-.670	898	.503	-.0274	.0409	-.1077	.0529
	Equal variances not assumed			-.673	290	.502	-.0274	.0408	-.1077	.0528
PRAP3	Equal variances assumed	7.964	.005	.641	898	.522	.0203	.0317	-.0419	.0826
	Equal variances not assumed			.609	272	.543	.0203	.0334	-.0454	.0860

Group Statistics

	GRAD3CAT	N	Mean	Std. Deviation	Std. Error Mean
PROM_SCR	Part Time	351	.4444	.4976	.0266
	None	714	.3810	.4860	.0182
ACADEMIC PROFILE CODE 1	Part Time	351	2.6952	.9264	.0494
	None	714	2.9398	.8609	.0322
ENGINEER	Part Time	351	.1339	.3410	.0182
	None	714	.1695	.3754	.0141
MATH	Part Time	351	.0655	.2478	.0132
	None	714	.0630	.2432	.0091
BIOPHY	Part Time	351	.1709	.3770	.0201
	None	714	.1373	.3444	.0129
SOCSCI	Part Time	351	.1966	.3980	.0212
	None	714	.1919	.3941	.0147
BUSINESS	Part Time	351	.1368	.3441	.0184
	None	714	.2213	.4154	.0155
HUMNEC	Part Time	351	.2963	.4573	.0244
	None	714	.2171	.4126	.0154
source—rotc college program	Part Time	351	.1994	.4001	.0214
	None	714	.1597	.3666	.0137
source—ocs	Part Time	351	.5014	.5007	.0267
	None	714	.5574	.4970	.0186
source—enl reserve other	Part Time	351	.0370	.1891	.0101
	None	714	.0350	.1839	.0069
source—usna	Part Time	351	.2621	.4404	.0235
	None	714	.2479	.4321	.0162
MAR_2PLS	Part Time	351	.5954	.4915	.0262
	None	714	.4930	.5003	.0187
MAR0_1C	Part Time	351	.2934	.4560	.0243
	None	714	.3529	.4782	.0179
SING_DIV	Part Time	351	.0741	.2623	.0140
	None	714	.0952	.2937	.0110
ATTACK	Part Time	351	.3561	.4795	.0256
	None	714	.3641	.4815	.0180
CSJET	Part Time	351	.2194	.4144	.0221
	None	714	.2367	.4254	.0159
CSPROP	Part Time	351	.0940	.2923	.0156
	None	714	.0798	.2712	.0102
FIGHTER	Part Time	351	.3305	.4711	.0251
	None	714	.3193	.4665	.0175
calc. from pildesyr & hpildsyr	Part Time	351	.6467	.4787	.0255
	None	714	.5812	.4937	.0185
N1NFO	Part Time	351	.3533	.4787	.0255
	None	714	.4188	.4937	.0185
MAINTOFF	Part Time	351	.4843	.5005	.0267
	None	714	.4734	.4996	.0187
OPSOFF	Part Time	351	.4701	.4998	.0267
	None	714	.4468	.4975	.0186
PRAP3	Part Time	351	.4858	.3833	.0205
	None	714	.4356	.3781	.0141

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
PROM_SCR	Equal variances assumed	11.584	.001	1.988	1063	.047	.0635	.0319	.0008	.1261
	Equal variances not assumed			1.972	682	.049	.0635	.0322	.0003	.1267
ACADEMIC PROFILE CODE 1	Equal variances assumed	12.436	.000	-4.250	1063	.000	-.2446	.0576	-.3576	-.1317
	Equal variances not assumed			-4.145	653	.000	-.2446	.0590	-.3605	-.1287
ENGINEER	Equal variances assumed	9.342	.002	-1.497	1063	.135	-.0356	.0238	-.0822	.0111
	Equal variances not assumed			-1.547	759	.122	-.0356	.0230	-.0807	.0096
MATH	Equal variances assumed	.098	.754	.157	1063	.875	.0025	.0160	-.0288	.0338
	Equal variances not assumed			.156	685	.876	.0025	.0161	-.0290	.0340
BIOPHY	Equal variances assumed	8.227	.004	1.454	1063	.146	.0337	.0232	-.0118	.0791
	Equal variances not assumed			1.410	643	.159	.0337	.0239	-.0132	.0806
SOCSCI	Equal variances assumed	.133	.716	.183	1063	.855	.0047	.0258	-.0459	.0553
	Equal variances not assumed			.182	690	.856	.0047	.0259	-.0461	.0555
BUSINESS	Equal variances assumed	49.032	.000	-3.297	1063	.001	-.0845	.0256	-.1349	-.0342
	Equal variances not assumed			-3.513	824	.000	-.0845	.0241	-.1318	-.0373

Independent Samples Test (cont.)

		Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
HUMNEC	Equal variances assumed	29.148	.000	2.840	1063	.005	.0792	.0279	.0245	.1339
	Equal variances not assumed			2.743	636	.006	.0792	.0289	.0225	.1359
source--rotc college program	Equal variances assumed	10.055	.002	1.614	1063	.107	.0398	.0246	-.0086	.0881
	Equal variances not assumed			1.567	644	.118	.0398	.0254	-.0101	.0896
source--ocs	Equal variances assumed	4.675	.031	-1.724	1063	.085	-.0560	.0325	-.1197	.0077
	Equal variances not assumed			-1.720	692	.086	-.0560	.0326	-.1199	.0079
source--enl reserve other	Equal variances assumed	.112	.738	.167	1063	.867	.0020	.0121	-.0217	.0258
	Equal variances not assumed			.166	679	.869	.0020	.0122	-.0220	.0260
source--usna	Equal variances assumed	.986	.321	.501	1063	.616	.0142	.0283	-.0414	.0698
	Equal variances not assumed			.498	684	.619	.0142	.0285	-.0418	.0702
MAR_2PLS	Equal variances assumed	26.360	.000	3.159	1063	.002	.1024	.0324	.0388	.1661
	Equal variances not assumed			3.178	707	.002	.1024	.0322	.0392	.1657
MAR0_1C	Equal variances assumed	16.695	.000	-1.938	1063	.053	-.0595	.0307	-.1197	.0008
	Equal variances not assumed			-1.969	727	.049	-.0595	.0302	-.1188	-.0002

127

Independent Samples Test (cont.)

		Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
SING_DIV	Equal variances assumed	5.352	.021	-1.144	1063	.253	-.0212	.0185	-.0575	.0151
	Equal variances not assumed			-1.189	771	.235	-.0212	.0178	-.0561	.0138
ATTACK	Equal variances assumed	.267	.606	-.256	1063	.798	-.0080	.0313	-.0695	.0535
	Equal variances not assumed			-.256	699	.798	-.0080	.0313	-.0695	.0534
CSJET	Equal variances assumed	1.624	.203	-.630	1063	.529	-.0173	.0275	-.0713	.0366
	Equal variances not assumed			-.636	713	.525	-.0173	.0273	-.0708	.0362
CSPROP	Equal variances assumed	2.421	.120	.782	1063	.434	.0142	.0181	-.0214	.0498
	Equal variances not assumed			.762	652	.446	.0142	.0186	-.0224	.0507
FIGHTER	Equal variances assumed	.523	.470	.366	1063	.715	.0112	.0305	-.0487	.0710
	Equal variances not assumed			.364	690	.716	.0112	.0306	-.0489	.0713
calc. from pildesyr & hpildsyr	Equal variances assumed	19.404	.000	2.055	1063	.040	.0655	.0319	.0030	.1280
	Equal variances not assumed			2.077	716	.038	.0655	.0315	.0036	.1274
N1NFO	Equal variances assumed	19.404	.000	-2.055	1063	.040	-.0655	.0319	-.1280	-.0030
	Equal variances not assumed			-2.077	716	.038	-.0655	.0315	-.1274	-.0036

Independent Samples Test (cont.)

		Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
MAINTOFF	Equal variances assumed	.363	.547	.336	1063	.737	.0109	.0326	-.0530	.0749
	Equal variances not assumed			.336	695	.737	.0109	.0326	-.0531	.0750
OPSOFF	Equal variances assumed	1.624	.203	.718	1063	.473	.0233	.0325	-.0404	.0870
	Equal variances not assumed			.716	693	.474	.0233	.0325	-.0406	.0872
PRAP3	Equal variances assumed	.051	.821	2.030	1063	.043	.0503	.0248	.0017	.0988
	Equal variances not assumed			2.020	688	.044	.0503	.0249	.0014	.0991

129

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF REFERENCES

Becker, G. S., "Investment in Human Capital: A Theoretical Analysis," *The Journal of Political Economy*, v. 70, p. 9-49, October, 1962.

Becker, G. S., *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education, National Bureau of Economic Research*, 2d ed., 1975.

Bowman, W. R. "Do Engineers Make Better Naval Officers?" *Armed Forces and Society*, pp. 271-286, Winter 1990.

Bowman, W. R., *"Dichotomous Dependent Variables and Regression Analysis Using SPSS."* Unpublished manuscript, United States Naval Academy, August 1998.

Bowman, W. R., and Mehay, S. L., "Graduate Education and Employee Performance: Evidence from Military Personnel," *Economics of Education Review*, v. 18, pp. 453-463, 1999.

Bureau of Naval Personnel, *"Manual of Navy Officer Manpower and Personnel, Volume II,"* 1992.

Bureau of Naval Personnel, *"Officer Transfer Manual,"* pp. 7-1 to 7-17, Change 3-99, 1999.

Buterbaugh, T. A., *A Multivariate Analysis of the Effects of Academic Performance and Graduate Education on the Promotion of Senior U.S. Navy Officers*, Master's Thesis, Naval Postgraduate School, Monterey, California, June, 1995.

Center for Naval Analyses, *A Bottom-Up Assessment of Navy Flagship Schools*, Cavalluzzo, L. C., and Cymrot, D. J., January, 1998.

Chief of Naval Operations, OPNAVINST 1520.23B, Subject: Graduate Education, 01 October 1991.

Chief of Naval Operations, OPNAV Notice 1520, Subject: Funded Graduate Education, 21 October 1996.

Chief of Naval Operations, Subject: Graduate Education Voucher Program, Formerly the Tuition Assurance Program, 041955Z Feb 00.

Commander, Navy Personnel Command, NAVPERS 15892, Perspective: The Navy Officers' Professional Bulletin, November – December, v. 1/99, p. 3, 1998.

DOD INST 1320.13, Subject: Commissioned Officer Promotion Reports (COPRS) and Procedures, Encl. 2: Desired Active Duty List Promotion Timing and Opportunity. June 21, 1996

Doeringer, P. B. and Piore, M. J., *Internal Labor Markets and Manpower Analysis*, Heath Lexicon Books, 1971.

Gates, Maruyama, Powers, Rosenthal, Cooper, "Faculty Response to the C.N.A. Assessment of the Naval Postgraduate School," Unpublished manuscript, Naval Postgraduate School, California,1999.

Gausch, J. L., and Weiss, A., "Self-Selection in the Labor Market," *The American Economic Review*, v. 71, pp. 275-284, June, 1981.

Heckman, J. J., "Sample Selection Bias as a Specification Error," *Econometrica*, v. 47, pp. 153-162, January, 1979.

Jacobs, T. O. & Jaques, E., "Executive Leadership," in R. Gal and A. D. Mangelsdorf (Eds.), *Handbook of Military Psychology,* John Wiley & Sons Ltd., 1991.

Lazear, E. P., "Academic Achievement and Job Performance: Note," *The American Economic Review*, v. 67, pp. 252-254, March, 1977.

Lazear, E., and Rosen, S., "Rank-Order Tournaments as Optimum Labor Contracts," *Journal of Political Economy*, v. 89, pp. 841-864, October, 1981.

Lazear, E. P., "A Jobs-Based Analysis of Labor Markets," *The American Economic Review*, v. 85, pp. 260-265, May, 1995.

N889J2, Head, Aviation Plans/Programs, "Naval Aviation Production Process Improvement: Background/Talking Points." [http://www.hq.navy.mil/Airwarfare/navysite/Talking%20Points%20for%20NAPPI%20032699.htm]. 1999.

Naval Postgraduate School, Department of the Navy, *NPS School Catalog, School Year 2000*, p. 18-28, 2000.

Office of the Undersecretary of Defense, Personnel and Readiness, *"Career Progression of Minority and Women Officers,"* p. 53, August 1999.

Orzell, M. S., *The Impact of Fully-Funded Graduate Education and Resident JPME on Aviator Promotion and Command Selection.* Master's Thesis, Naval Postgraduate School, Monterey, California, March, 1998.

Oswald, A. J., "Wage and Employment Structure in an Economy with Internal Labor Markets," The Quarterly Journal of Economics, v. 99, pp. 693-716, November, 1984.

Pers-85, "FY-01 Active Duty Officer Promotion Selection Board Guidance." [http://www.bupers.navy.mil/pers8/p85/p85l/o6.htm]. April 2000.

Rosen, S., "The Military as an Internal Labor Market: Some Allocation, Productivity, and Incentive Problems," *Social Science Quarterly*, v. 73, pp. 227-237, June, 1992.

Salop, J., and Salop, S., "Self-Selection and Turnover in the Labor Market," *The Quarterly Journal of Economics*, v. 90, pp. 619-627, November, 1976.

Schein, E. H., *Organizational Culture and Leadership*, 2d ed., Jossey-Bass Publishers, 1997.

Wise, D. A., "Personal Attributes, Job Performance, and Probability of Promotion," *Econometrica*, v. 43, pp. 913-932, September-November, 1975.

THIS PAGE INTENTIONALLY LEFT BLANK

BIBLIOGRAPHY

Norusis, Marija J. (1998). "SPSS 8.0: Guide to Data Analysis." New Jersey: Prentice-Hall, Inc.

THIS PAGE INTENTIONALLY LEFT BLANK

INITIAL DISTRIBUTION LIST

1. Defense Technical Information Center 2
    8725 John J. Kingman Road, Ste 0944
    Fort Belvoir, VA 22060-6218

2. Dudley Knox Library 2
    Naval Postgraduate School
    411 Dyer Road
    Monterey, California 93943-5101

3. Nimitz Library 1
    U. S. Naval Academy
    589 McNair Rd.
    Annapolis, MD 21402-5029

4. Superintendent 1
    United States Naval Academy
    Annapolis, MD 21402-5029

5. United States Naval Academy 1
    Office of Institutional Research
    Stop 2B
    Annapolis, MD 21402-5029

6. Professor William R. Bowman 2
    Department of Economics
    United States Naval Academy
    Annapolis, MD 21402

7. Professor Stephen L. Mehay 2
    Naval Postgraduate School
    Systems Management Department
    411 Dyer Road
    Monterey, CA 93943-5101

8. LT William B. Phillips 3
    10 Perry Circle, Apt. A
    Annapolis, MD 21402

9. Mr. W. L. Phillips, Jr. 1
    298 Yale Court
    Arnold, MD 21012